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Guide To Wheat Hardness

GUIDE TO WHEAT HARDNESS

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Introduction

The Official U.S. Standards for Wheat divides wheat into seven classes, such as soft red winter, hard red winter, hard red spring, and white. Wheat class, the first determination made on wheat after dockage removal, is used as an indicator of appropriate end use. Currently, wheat class is determined solely by visual inspection of kernel color and such morphological characteristics as kernel shape and length, and shapes of the germ, crease, and brush. If a wheat sample has the specified external kernel characteristics of a hard or soft wheat, it is so identified without any physical determination of its relative hardness or softness.

However, many newly released varieties no longer exhibit the traditional visual characteristics of their class. For example, some soft red winter varieties have kernel characteristics previously exhibited only by hard red winter varieties and vice versa. Since the "hard" or "soft" designation provides important information on tempering and milling requirements and end-use performance, proper classification of wheat is important to orderly marketing and utilization.

The U.S. Congress in the Food Security Act of 1985, PL-99-198 (farm bill), charged the Federal Grain Inspection Service (FGIS) and the Agricultural

Research Service (ARS) to collaborate in the development of a new system of classifying wheat. In June 1986, the Administrator of FGIS established the Wheat Classification Working Group (WCWG) to guide and oversee the ongoing effort to develop such a system. WCWG membership was drawn from all relevant sectors of the wheat industry, including growers, seed producers, breeders, millers, end users, and trade organizations. The primary goal of the collaborative effort by FGIS, ARS, and WCWG is to establish an objective, accurate, and efficient system for classifying wheat. Also, the WCWG has insisted that the system pose no major risk of market disruption. Consistent with these requirements, the collaborators identified the development of an objective method for measuring hardness as their first objective.

Wheat hardness, despite wide usage, is a concept for which no physical-property definition has been universally accepted. In 1986, Norris et al. (in press) developed a definition of wheat hardness based on certain near-infrared reflectance (NIR) measurements of ground wheat samples. The basis of their definition is that (1) the particle size of ground wheat correlates directly with the hardness of the wheat kernel and (2) near-infrared light is more highly absorbed by larger particles than by smaller particles. They developed a standardized procedure for grinding wheat samples, taking the required NIR measurements, and translating the measurements into hardness scores. Their procedure was verified by a collaborative study and accepted as a standard by the American Association of Cereal Chemists (AACC) (1986). The WCWG has endorsed NIR hardness scores as the reference definition of wheat hardness; it has also endorsed the development of any new classification system that is based on those scores.

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Sample collection by Joe Hampton of the ENID Board of Trade and Rollie Sears of Kansas State University, and the assistance of Joyce Shaffer, ARS, in sample analysis are greatly appreciated.

An advantage of developing such a system is that NIR wheat hardness can be measured by most NIR instruments currently available for use with agricultural commodities. NIR instruments are used, for example, to measure protein in the national wheat inspection system, and to measure chemical components of forages and feedstuffs.

This publication presents the results of a study to determine the NIR hardness scores for a broad spectrum of wheat varieties grown at different locations. The scores represent an important first step in the development of a new wheat classification system. They form an initial data base from which some understanding may be gained about the effects of variety, growing conditions, and environment on wheat hardness. In addition, the values represent the first objective evaluation of wheat hardness nationwide and can help wheat growers, breeders, millers, and bakers select the wheat hardnesses best suited to their specific applications.

Procedure

Approximately 1,900 wheat samples were collected for this hardness study during the 1988 crop year. Samples were obtained from 10 States and include more than 125 varieties. Two sets of wheat samples were collected: one, drawn from commercial channels and identified as to variety by the farmer at the time of delivery to the local grain elevator; the second, from wheat breeders' variety trials. All samples were cleaned prior to analysis by official FGIS procedures to remove dockage and shrunken and broken kernels.

The samples (about 15 g per sample) were ground in a UDY cyclone grinder (model 3010-018), passed through a 1-mm screen, and analyzed with a Pacific Scientific spectrophotometer (model 6250).

Standardization of the NIR hardness measurement for the grinder, the spectrophotometer, and the laboratory technician involved in this study were conducted according to the AACC method by using the FGIS standard reference samples. The standardization for this study resulted in an average variance of 3 between replications.

Discussion

NIR hardness was developed on a scale of 0-100, 100 being the hardest. Soft wheats typically scored about 25 and hard wheats about 75. A specified hardness score does not necessarily imply the same level of quality to all end users, since the significance of a hardness value or range is established by the end user for each end product.

The NIR wheat hardness values are shown for the samples in tables 1-4. Tables 1 and 3 show the hardness values for the samples collected through commercial channels, while tables 2 and 4 show the hardness values for samples collected from the breeders' variety trials. Tables 1 and 2 are organized alphabetically by State abbreviation and then by region (city or county) within the State, and finally by NIR hardness within each variety. Tables 3 and 4 are organized alphabetically by variety and then by NIR wheat hardness within each variety. Table 5 summarizes the NIR hardness information by giving the average hardness value for each variety within each State.

In addition to information about wheat hardness for specified varieties and locations, the hardness tables provide information about the combined effects of variety and location on wheat hardness. For example, the four common hard red spring wheat varieties Butte-86, Len, Marshall, and Stoa show a general pattern of increasing hardness with increasing latitude. The soft

wheat variety Caldwell appears to be softer when grown in Kansas than when grown in Ohio or Missouri. Among the varieties of hard red winter wheat from Oklahoma or Texas, Mustang and Tam-101 could be expected to be harder than Chisholm.

Occasionally, the tables show that only a few samples were analyzed for a given variety and region. In those instances, the reader is reminded that the NIR hardness scores may not be representative of that variety over the entire region. Also, hardness values can fluctuate under varying environmental conditions, and the data presented here represent only wheat samples collected in the 1988 crop year. For example, the hardness values of wheats grown in Reno County, KS, are lower than expected because of kernel

shriveled due to a heavy infection by wheat streak mosaic virus. The variety names identified for the samples collected in this study were not verified, and the names shown may be incomplete in some cases.

Literature Cited

American Association of Cereal Chemists. 1986. Method 39-70. Wheat Hardness as Determined by Near-Infrared Reflectance. Rev. 11-4-87. Approved Methods of the American Association of Cereal Chemists. 8th Ed. St. Paul, MN.

Norris, K.H., W.R. Hruschka, M.M. Bean, and D.C. Slaughter. [In press.] A definition of wheat hardness using near-infrared reflectance spectroscopy. Cereal Foods World.

TABLE 1. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|--------------|---------|-------------|-------|----------|
| CA | ARBUCKLE | 95912 | ANZA | HRW | 68 |
| CA | ARBUCKLE | 95912 | ANZA | HRW | 69 |
| CA | ARBUCKLE | 95912 | ANZA | HRW | 73 |
| CA | ARBUCKLE | 95912 | ANZA | HRW | 75 |
| CA | CHICO | 95926 | ANZA | HRW | 77 |
| CA | CLARKSBURG | 95612 | ANZA | HRW | 73 |
| CA | CLARKSBURG | 95612 | ANZA | HRW | 76 |
| CA | DAVIS | 95616 | ANZA | HRW | 73 |
| CA | DIXON | 95620 | KLASSIC | HWW | 62 |
| CA | DIXON | 95620 | KLASSIC | HWW | 62 |
| CA | DIXON | 95620 | KLASSIC | HWW | 64 |
| CA | DIXON | 95620 | KLASSIC | HWW | 64 |
| CA | DIXON | 95620 | KLASSIC | HWW | 65 |
| CA | DIXON | 95620 | KLASSIC | HWW | 68 |
| CA | DIXON | 95620 | KLASSIC | HWW | 68 |
| CA | GERBER | 96035 | ANZA | HRW | 66 |
| CA | GOSHEN | 93227 | YECORA-ROJO | HRW | 71 |
| CA | GOSHEN | 93227 | YECORA-ROJO | HRW | 71 |
| CA | GOSHEN | 93227 | YECORA-ROJO | HRW | 71 |
| CA | GOSHEN | 93227 | YECORA-ROJO | HRW | 71 |
| CA | GOSHEN | 93227 | YECORA-ROJO | HRW | 71 |
| CA | GOSHEN | 93227 | YECORA-ROJO | HRW | 72 |
| CA | GOSHEN | 93227 | YECORA-ROJO | HRW | 72 |
| CA | GOSHEN | 93227 | YECORA-ROJO | HRW | 72 |
| CA | GOSHEN | 93227 | YECORA-ROJO | HRW | 72 |
| CA | GOSHEN | 93227 | YECORA-ROJO | HRW | 72 |
| CA | GOSHEN | 93227 | YECORA-ROJO | HRW | 73 |
| CA | GOSHEN | 93227 | YECORA-ROJO | HRW | 73 |
| CA | GOSHEN | 93227 | YECORA-ROJO | HRW | 73 |
| CA | GOSHEN | 93227 | YECORA-ROJO | HRW | 73 |
| CA | GOSHEN | 93227 | YECORA-ROJO | HRW | 74 |
| CA | GOSHEN | 93227 | YECORA-ROJO | HRW | 74 |
| CA | GOSHEN | 93227 | YECORA-ROJO | HRW | 75 |
| CA | GOSHEN | 93227 | YECORA-ROJO | HRW | 76 |
| CA | GOSHEN | 93227 | YECORA-ROJO | HRW | 76 |
| CA | GOSHEN | 93227 | YECORA-ROJO | HRW | 77 |
| CA | GOSHEN | 93227 | YECORA-ROJO | HRW | 77 |
| CA | PALERNEO | 95968 | ANZA | HRW | 76 |
| CA | VACAVILLE | 95688 | ANZA | HRW | 77 |
| CA | WALNUT-GROVE | 95690 | ANZA | HRW | 75 |
| CA | WALNUT-GROVE | 95690 | ANZA | HRW | 78 |
| CA | WALNUT-GROVE | 95690 | ANZA | HRW | 83 |
| CA | WOODLAND | 95695 | ANZA | HRW | 77 |
| CA | WOODLAND | 95695 | ANZA | HRW | 77 |
| CA | WOODLAND | 95695 | ANZA | HRW | 84 |
| CO | ARRIBA | 80804 | SANDY | HRW | 72 |
| CO | COPE | 80812 | HAWK | HRW | 75 |
| CO | COPE | 80812 | TAM-105 | HRW | 83 |
| CO | HUGO | 80821 | TAM-107 | HRW | 80 |
| CO | IDALIA | 80735 | BRULE | HRW | 46 |
| CO | IDALIA | 80735 | BRULE | HRW | 61 |
| CO | IDALIA | 80735 | HAWK | HRW | 61 |

TABLE 1. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|--------|---------|-------------|-------|----------|
| CO | IDALIA | 80735 | MUSTANG | HRW | 53 |
| CO | IDALIA | 80735 | SCOUT-66 | HRW | 62 |
| CO | IDALIA | 80735 | SCOUT-66 | HRW | 65 |
| CO | IDALIA | 80735 | TAM-107 | HRW | 66 |
| CO | IDALIA | 80735 | TAM-108 | HRW | 33 |
| CO | IDALIA | 80735 | THUNDERBIRD | HRW | 66 |
| CO | IDALIA | 80735 | VICTORY | HRW | 60 |
| CO | IDALIA | 80735 | WINGS | HRW | 45 |
| CO | IDALIA | 80735 | WINGS | HRW | 50 |
| CO | LIMON | 80828 | CARSON | HRW | 65 |
| CO | LIMON | 80828 | HAWK | HRW | 70 |
| CO | LIMON | 80828 | LARNED | HRW | 69 |
| CO | LIMON | 80828 | VICTORY | HRW | 65 |
| CO | LIMON | 80828 | VONA | HRW | 65 |
| CO | OTIS | 80743 | CARSON | HRW | 68 |
| CO | OTIS | 80743 | HAWK | HRW | 66 |
| CO | OTIS | 80743 | MESA | HRW | 65 |
| CO | OTIS | 80743 | MUSTANG | HRW | 52 |
| CO | OTIS | 80743 | NEWTON | HRW | 57 |
| CO | OTIS | 80743 | NEWTON | HRW | 64 |
| CO | OTIS | 80743 | STALLION | HRW | 57 |
| CO | OTIS | 80743 | TAM-107 | HRW | 79 |
| CO | OTIS | 80743 | TAM-107 | HRW | 81 |
| CO | OTIS | 80743 | TAM-107 | HRW | 85 |
| CO | OTIS | 80743 | THUNDERBIRD | HRW | 67 |
| CO | OTIS | 80743 | VICTORY | HRW | 65 |
| CO | OTIS | 80743 | VICTORY | HRW | 68 |
| CO | OTIS | 80743 | VONA | HRW | 68 |
| CO | PEETZ | 80747 | BRULE | HRW | 53 |
| CO | PEETZ | 80747 | BRULE | HRW | 62 |
| CO | PEETZ | 80747 | BRULE | HRW | 74 |
| CO | PEETZ | 80747 | HAIL | HRW | 58 |
| CO | PEETZ | 80747 | HAWK | HRW | 53 |
| CO | PEETZ | 80747 | HAWK | HRW | 61 |
| CO | PEETZ | 80747 | SANDY | HRW | 66 |
| CO | PEETZ | 80747 | SCOUT | HRW | 62 |
| CO | PEETZ | 80747 | SUPER-HAWK | HRW | |
| CO | PEETZ | 80747 | TAM-108 | HRW | |
| CO | PEETZ | 80747 | VONA | HRW | |
| CO | PEETZ | 80747 | VONA | HRW | |
| CO | PEETZ | 80747 | VONA | HRW | |
| CO | PEETZ | 80747 | VONA | HRW | |
| CO | PEETZ | 80747 | VONA | HRW | |
| CO | PIERCE | 80650 | SANDY | HRW | |
| CO | PIERCE | 80650 | SANDY | HRW | |
| CO | PIERCE | 80650 | SANDY | HRW | |
| CO | PIERCE | 80650 | SANDY | HRW | |
| CO | PIERCE | 80650 | SANDY | HRW | |
| CO | PIERCE | 80650 | SANDY | HRW | |
| CO | PIERCE | 80650 | SANDY | HRW | |

TABLE 1. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|-------------|---------|---------------|-------|----------|
| CO | PIERCE | 80650 | SANDY | HRW | 65 |
| CO | PIERCE | 80650 | SANDY | HRW | 65 |
| CO | PIERCE | 80650 | SANDY | HRW | 66 |
| CO | PIERCE | 80650 | SANDY | HRW | 67 |
| CO | PIERCE | 80650 | SANDY | HRW | 68 |
| CO | PIERCE | 80650 | SANDY | HRW | 68 |
| CO | PIERCE | 80650 | SANDY | HRW | 71 |
| CO | RUSH | 80833 | BACA | HRW | 63 |
| CO | VILAS | 81087 | BACA | HRW | 56 |
| CO | VILAS | 81087 | BACA | HRW | 59 |
| CO | VILAS | 81087 | BACA | HRW | 61 |
| KS | ANTHONY | 67003 | ARKAN | HRW | 62 |
| KS | ANTHONY | 67003 | HAWK | HRW | 55 |
| KS | ANTHONY | 67003 | MUSTANG | HRW | 53 |
| KS | ANTHONY | 67003 | PIONEER-2157 | HRW | 51 |
| KS | ANTHONY | 67003 | TAM-101 | HRW | 55 |
| KS | ANTHONY | 67003 | TAM-101 | HRW | 58 |
| KS | ANTHONY | 67003 | TRIUMPH | HRW | 62 |
| KS | ANTHONY | 67003 | WINGS | HRW | 59 |
| KS | ANTHONY | 67003 | WRANGLER | HRW | 66 |
| KS | ASHERVILLE | 67420 | ARKAN | HRW | 63 |
| KS | ASHERVILLE | 67420 | MUSTANG | HRW | 69 |
| KS | ASHERVILLE | 67420 | NEWTON | HRW | 56 |
| KS | ASHERVILLE | 67420 | PRO-BRAND-830 | HRW | 70 |
| KS | ASHERVILLE | 67420 | PRO-BRAND-830 | HRW | 73 |
| KS | ASHERVILLE | 67420 | TAM-105 | HRW | 60 |
| KS | ASHERVILLE | 67420 | THUNDERBIRD | HRW | 76 |
| KS | ASHERVILLE | 67420 | TRAILBLAZER | HRW | 67 |
| KS | ASHERVILLE | 67420 | VICTORY | HRW | 69 |
| KS | ASHERVILLE | 67420 | VICTORY | HRW | 75 |
| KS | BLUE-RAPIDS | 66411 | ARKAN | HRW | 62 |
| KS | BLUE-RAPIDS | 66411 | ARKAN | HRW | 67 |
| KS | BLUE-RAPIDS | 66411 | HAWK | HRW | 75 |
| KS | BLUE-RAPIDS | 66411 | NEWTON | HRW | 61 |
| KS | BLUE-RAPIDS | 66411 | NEWTON | HRW | 61 |
| KS | BLUE-RAPIDS | 66411 | NEWTON | HRW | 63 |
| KS | BLUE-RAPIDS | 66411 | NEWTON | HRW | 70 |
| KS | BLUE-RAPIDS | 66411 | THUNDERBIRD | HRW | 80 |
| KS | BLUFF-CITY | 67018 | ARKAN | HRW | 56 |
| KS | BLUFF-CITY | 67018 | MUSTANG | HRW | 58 |
| KS | BLUFF-CITY | 67018 | PIONEER-2157 | HRW | 55 |
| KS | BLUFF-CITY | 67018 | PIONEER-2157 | HRW | 57 |
| KS | BLUFF-CITY | 67018 | PIONEER-2172 | HRW | 57 |
| KS | BREWSTER | 67732 | EAGLE | HRW | 73 |
| KS | BREWSTER | 67732 | HAWK | HRW | 64 |
| KS | BREWSTER | 67732 | HAWK | HRW | 65 |
| KS | BREWSTER | 67732 | LARNED | HRW | 74 |
| KS | BREWSTER | 67732 | MUSTANG | HRW | 62 |
| KS | BREWSTER | 67732 | NEWTON | HRW | 58 |
| KS | BREWSTER | 67732 | NEWTON | HRW | 61 |
| KS | BREWSTER | 67732 | SCOUT-66 | HRW | 77 |

TABLE 1. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|------------|---------|---------------|-------|----------|
| KS | BREWSTER | 67732 | THUNDERBIRD | HRW | 68 |
| KS | BREWSTER | 67732 | THUNDERBIRD | HRW | 82 |
| KS | BURDICK | 66838 | ARKAN | HRW | 63 |
| KS | CANTON | 67428 | ARKAN | HRW | 49 |
| KS | CANTON | 67428 | ARKAN | HRW | 52 |
| KS | CANTON | 67428 | ARKAN | HRW | 54 |
| KS | CANTON | 67428 | ARKAN | HRW | 60 |
| KS | CANTON | 67428 | NEWTON | HRW | 52 |
| KS | CANTON | 67428 | PIONEER | HRW | 53 |
| KS | CANTON | 67428 | PIONEER-2157 | HRW | 51 |
| KS | CANTON | 67428 | PRO-BRAND-830 | HRW | 72 |
| KS | CANTON | 67428 | TRIUMPH | HRW | 56 |
| KS | CANTON | 67428 | VICTORY | HRW | 51 |
| KS | CHANUTE | 66720 | AGRI-PRO | HRW | 52 |
| KS | CHANUTE | 66720 | ARKAN | HRW | 56 |
| KS | CHANUTE | 66720 | ARKAN | HRW | 57 |
| KS | CHANUTE | 66720 | ARKAN | HRW | 57 |
| KS | CHANUTE | 66720 | MUSTANG | HRW | 71 |
| KS | CHANUTE | 66720 | PARKER | HRW | 64 |
| KS | CHANUTE | 66720 | PARKER | HRW | 73 |
| KS | CHANUTE | 66720 | TRIUMPH | HRW | 59 |
| KS | CHANUTE | 66720 | TRIUMPH | HRW | 60 |
| KS | CHANUTE | 66720 | TRIUMPH | HRW | 70 |
| KS | CHERRYVALE | 67335 | ARKAN | HRW | 55 |
| KS | CHERRYVALE | 67335 | ARKAN | HRW | 57 |
| KS | CHERRYVALE | 67335 | ARKAN | HRW | 70 |
| KS | CHERRYVALE | 67335 | CALDWELL | SRW | 22 |
| KS | CHERRYVALE | 67335 | CALDWELL | SRW | 25 |
| KS | CHERRYVALE | 67335 | MUSTANG | HRW | 67 |
| KS | CHERRYVALE | 67335 | TAM-107 | HRW | 57 |
| KS | CHERRYVALE | 67335 | TAM-108 | HRW | 50 |
| KS | CHERRYVALE | 67335 | VICTORY | HRW | 60 |
| KS | COLDWATER | 67029 | EAGLE | HRW | 68 |
| KS | COLDWATER | 67029 | HAWK | HRW | 67 |
| KS | COLDWATER | 67029 | MUSTANG | HRW | 60 |
| KS | COLDWATER | 67029 | SAGE | HRW | 68 |
| KS | COLDWATER | 67029 | SIOUXLAND | HRW | 68 |
| KS | COLDWATER | 67029 | THUNDERBIRD | HRW | 69 |
| KS | COLDWATER | 67029 | THUNDERBIRD | HRW | 71 |
| KS | COLDWATER | 67029 | VICTORY | HRW | 71 |
| KS | COLDWATER | 67029 | VONA | HRW | 66 |
| KS | CUNNINGHAM | 67035 | ARKAN | HRW | 68 |
| KS | CUNNINGHAM | 67035 | HAWK | HRW | 70 |
| KS | CUNNINGHAM | 67035 | NEWTON | HRW | 60 |
| KS | CUNNINGHAM | 67035 | VICTORY | HRW | 67 |
| KS | CUNNINGHAM | 67035 | WRANGLER | HRW | 65 |
| KS | DILLWYN | 67557 | ARKAN | HRW | 64 |
| KS | DILLWYN | 67557 | HAWK | HRW | 71 |
| KS | DILLWYN | 67557 | NEWTON | HRW | 64 |
| KS | DILLWYN | 67557 | TAM-108 | HRW | 55 |
| KS | DILLWYN | 67557 | VICTORY | HRW | 64 |

TABLE 1. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|----------|---------|---------------|-------|----------|
| KS | EUREKA | 67045 | ARKAN | HRW | 58 |
| KS | EUREKA | 67045 | ARKAN | HRW | 58 |
| KS | EUREKA | 67045 | ARKAN | HRW | 61 |
| KS | EUREKA | 67045 | ARKAN | HRW | 62 |
| KS | EUREKA | 67045 | ARKAN | HRW | 63 |
| KS | EUREKA | 67045 | ARKAN | HRW | 68 |
| KS | EUREKA | 67045 | ARKAN | HRW | 69 |
| KS | EUREKA | 67045 | THUNDERBIRD | HRW | 65 |
| KS | EUREKA | 67045 | TRIUMPH | HRW | 57 |
| KS | EUREKA | 67045 | VICTORY | HRW | 63 |
| KS | GENESEO | 67444 | ARKAN | HRW | 53 |
| KS | GENESEO | 67444 | ARKAN | HRW | 58 |
| KS | GENESEO | 67444 | ARKAN | HRW | 60 |
| KS | GENESEO | 67444 | ARKAN | HRW | 62 |
| KS | GENESEO | 67444 | ARKAN | HRW | 63 |
| KS | GENESEO | 67444 | ARKAN | HRW | 72 |
| KS | GENESEO | 67444 | CHENEY | HRW | 52 |
| KS | GENESEO | 67444 | NEWTON | HRW | 56 |
| KS | GENESEO | 67444 | NEWTON | HRW | 56 |
| KS | GENESEO | 67444 | NEWTON | HRW | 66 |
| KS | GENESEO | 67444 | STIOUXLAND | HRW | 69 |
| KS | GOODLAND | 67735 | BRULE | HRW | 65 |
| KS | GOODLAND | 67735 | GARST | HRW | 62 |
| KS | GOODLAND | 67735 | LARNED | HRW | 60 |
| KS | GOODLAND | 67735 | MUSTANG | HRW | 64 |
| KS | GOODLAND | 67735 | NEWTON | HRW | 64 |
| KS | GOODLAND | 67735 | NEWTON | HRW | 65 |
| KS | GOODLAND | 67735 | NEWTON | HRW | 65 |
| KS | GOODLAND | 67735 | NEWTON | HRW | 53 |
| KS | GOODLAND | 67735 | PIONEER | HRW | 67 |
| KS | GOODLAND | 67735 | SCOUT-66 | HRW | 62 |
| KS | HARDTNER | 67057 | ARKAN | HRW | 40 |
| KS | HARDTNER | 67057 | CHISHOLM | HRW | 55 |
| KS | HARDTNER | 67057 | PIONEER-2157 | HRW | 77 |
| KS | HARDTNER | 67057 | ROCKY | HRW | 64 |
| KS | HARDTNER | 67057 | VICTORY | HRW | 57 |
| KS | HIAWATHA | 66434 | ARKAN | HRW | 64 |
| KS | HIAWATHA | 66434 | ARKAN | HRW | 67 |
| KS | HIAWATHA | 66434 | ARKAN | HRW | 78 |
| KS | HIAWATHA | 66434 | ARKAN | HRW | 84 |
| KS | HIAWATHA | 66434 | BOUNTY | HRW | 77 |
| KS | HIAWATHA | 66434 | NEWTON | HRW | 64 |
| KS | HIAWATHA | 66434 | PRO-BRAND-830 | HRW | 64 |
| KS | HIAWATHA | 66434 | VICTORY | HRW | 66 |
| KS | HIAWATHA | 66434 | VICTORY | HRW | 65 |
| KS | HOLTON | 66436 | ARKAN | HRW | 66 |
| KS | HOLTON | 66436 | ARKAN | HRW | 76 |
| KS | HOLTON | 66436 | ARKAN | HRW | 57 |
| KS | HOLTON | 66436 | NEWTON | HRW | 61 |
| KS | HOLTON | 66436 | NEWTON | HRW | 65 |
| KS | HOLTON | 66436 | NEWTON | HRW | 63 |
| KS | HOLTON | 66436 | VICTORY | HRW | 63 |

HARDNESS OF COMMERCIAL SAMPLES, LISTED BY LOCATION.

| | ZIPCODE | VARIETY | CLASS | HARDNESS |
|------|---------|--------------|-------|----------|
| | 66436 | VICTORY | HRW | 65 |
| | 66436 | VICTORY | HRW | 66 |
| | 66436 | VICTORY | HRW | 66 |
| | 67951 | HAWK | HRW | 74 |
| | 67951 | MUSTANG | HRW | 73 |
| I | 67951 | MUSTANG | HRW | 73 |
| I | 67951 | MUSTANG | HRW | 75 |
| J | 67951 | MUSTANG | HRW | 82 |
| J | 67951 | NEWTON | HRW | 63 |
| N | 67951 | THUNDERBIRD | HRW | 72 |
| N | 67951 | THUNDERBIRD | HRW | 79 |
| N | 67951 | VICTORY | HRW | 78 |
| N | 67951 | VICTORY | HRW | 79 |
| NSON | 67504 | HAWK | HRW | 69 |
| NSON | 67504 | SIOUXLAND | HRW | 62 |
| RE | 67854 | EAGLE | HRW | 69 |
| RE | 67854 | HAWK | HRW | 74 |
| RE | 67854 | HAWK | HRW | 77 |
| RE | 67854 | LARNED | HRW | 72 |
| RE | 67854 | MUSTANG | HRW | 73 |
| RE | 67854 | NEWTON | HRW | 65 |
| RE | 67854 | PIONEER-2157 | HRW | 65 |
| RE | 67854 | SCOUT-66 | HRW | 76 |
| RE | 67854 | TAM-107 | HRW | 77 |
| RE | 67854 | VICTORY | HRW | 73 |
| RADO | 67741 | HAWK | HRW | 71 |
| RADO | 67741 | LARNED | HRW | 74 |
| RADO | 67741 | NEWTON | HRW | 60 |
| RADO | 67741 | VONA | HRW | 59 |
| MAN | 67068 | DODGE | HRW | 61 |
| MAN | 67068 | TRIUMPH | HRW | 57 |
| MAN | 67068 | VICTORY | HRW | 62 |
| E-CO | 67839 | HAWK | HRW | 68 |
| E-CO | 67839 | HAWK | HRW | 72 |
| E-CO | 67839 | LARNED | HRW | 74 |
| E-CO | 67839 | LARNED | HRW | 78 |
| E-CO | 67839 | MUSTANG | HRW | 67 |
| E-CO | 67839 | MUSTANG | HRW | 69 |
| E-CO | 67839 | NEWTON | HRW | 62 |
| E-CO | 67839 | PIONEER-2157 | HRW | 61 |
| E-CO | 67839 | TAM-107 | HRW | 79 |
| E-CO | 67839 | VICTORY | HRW | 62 |
| E-CO | 67839 | VICTORY | HRW | 35 |
| OTI | 67861 | BOUNTY-205 | HRW | 39 |
| OTI | 67861 | BOUNTY-205 | HRW | 78 |
| OTI | 67861 | EAGLE | HRW | 79 |
| OTI | 67861 | EAGLE | HRW | 65 |
| OTI | 67861 | HAWK | HRW | 75 |
| OTI | 67861 | HAWK | HRW | 64 |
| OTI | 67861 | LARNED | HRW | 66 |
| OTI | 67861 | LARNED | HRW | 69 |
| OTI | 67861 | LARNED | HRW | 69 |

TABLE 1. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|-------------|---------|---------------|-------|----------|
| KS | LEOTI | 67861 | LARNED | HRW | 69 |
| KS | LEOTI | 67861 | LARNED | HRW | 75 |
| KS | LEOTI | 67861 | LARNED | HRW | 75 |
| KS | LEOTI | 67861 | NEWTON | HRW | 66 |
| KS | LEOTI | 67861 | TAM-105 | HRW | 77 |
| KS | LEOTI | 67861 | TAM-105 | HRW | 78 |
| KS | LEOTI | 67861 | TAM-105 | HRW | 79 |
| KS | LEOTI | 67861 | TAM-105 | HRW | 82 |
| KS | LEOTI | 67861 | TAM-105 | HRW | 85 |
| KS | LEOTI | 67861 | TAM-107 | HRW | 76 |
| KS | LEOTI | 67861 | TAM-107 | HRW | 83 |
| KS | LINCOLN | 67455 | ARKAN | HRW | 64 |
| KS | LINCOLN | 67455 | ARKAN | HRW | 65 |
| KS | LINCOLN | 67455 | ARKAN | HRW | 65 |
| KS | LINCOLN | 67455 | ARKAN | HRW | 68 |
| KS | LINCOLN | 67455 | GARST-HR64 | HRW | 76 |
| KS | LINCOLN | 67455 | MUSTANG | HRW | 66 |
| KS | LINCOLN | 67455 | NK-830 | HRW | 76 |
| KS | LINCOLN | 67455 | NK-830 | HRW | 78 |
| KS | LINCOLN | 67455 | TAM-107 | HRW | 56 |
| KS | LINCOLN | 67455 | VICTORY | HRW | 67 |
| KS | LONGFORD | 67458 | ARKAN | HRW | 57 |
| KS | LONGFORD | 67458 | NEWTON | HRW | 56 |
| KS | LONGFORD | 67458 | NEWTON | HRW | 57 |
| KS | LONGFORD | 67458 | PRO-BRAND-830 | HRW | 72 |
| KS | LONGFORD | 67458 | VICTORY | HRW | 61 |
| KS | LONGFORD | 67458 | VICTORY | HRW | 66 |
| KS | LONGFORD | 67458 | VICTORY | HRW | 66 |
| KS | LORRAINE | 67459 | ARKAN | HRW | 60 |
| KS | LORRAINE | 67459 | ARKAN | HRW | 60 |
| KS | LORRAINE | 67459 | ARKAN | HRW | 62 |
| KS | LORRAINE | 67459 | MUSTANG | HRW | 63 |
| KS | LORRAINE | 67459 | PIONEER-2157 | HRW | 58 |
| KS | LORRAINE | 67459 | PIONEER-2157 | HRW | 61 |
| KS | LORRAINE | 67459 | PIONEER-2157 | HRW | 65 |
| KS | LORRAINE | 67459 | PIONEER-2165 | HRW | 66 |
| KS | LORRAINE | 67459 | PRO-BRAND-830 | HRW | 69 |
| KS | LORRAINE | 67459 | VICTORY | HRW | 61 |
| KS | MANCHESTER | 67463 | MUSTANG | HRW | 71 |
| KS | MANCHESTER | 67463 | PRO-BRAND-830 | HRW | 61 |
| KS | MANHATTAN | 66502 | ARKAN | HRW | 55 |
| KS | MANHATTAN | 66502 | ARKAN | HRW | 58 |
| KS | MANHATTAN | 66502 | ARKAN | HRW | 66 |
| KS | MANHATTAN | 66502 | MUSTANG | HRW | 65 |
| KS | MANHATTAN | 66502 | MUSTANG | HRW | 75 |
| KS | MANHATTAN | 66502 | NEWTON | HRW | 61 |
| KS | MANHATTAN | 66502 | NEWTON | HRW | 66 |
| KS | MANHATTAN | 66502 | TRIUMPH | HRW | 75 |
| KS | MANHATTAN | 66502 | VICTORY | HRW | 62 |
| KS | MANHATTAN | 66502 | VICTORY | HRW | 68 |
| KS | MINNEAPOLIS | 67467 | ARKAN | HRW | 54 |

TABLE 1. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|--------------|---------|---------------|-------|----------|
| KS | MINNEAPOLIS | 67467 | ARKAN | HRW | 55 |
| KS | MINNEAPOLIS | 67467 | ARKAN | HRW | 62 |
| KS | MINNEAPOLIS | 67467 | HAWK | HRW | 56 |
| KS | MINNEAPOLIS | 67467 | NEWTON | HRW | 69 |
| KS | MINNEAPOLIS | 67467 | NEWTON | HRW | 76 |
| KS | MINNEAPOLIS | 67467 | PIONEER-2157 | HRW | 56 |
| KS | MINNEAPOLIS | 67467 | PRO-BRAND-830 | HRW | 65 |
| KS | MINNEAPOLIS | 67467 | SIOUXLAND | HRW | 67 |
| KS | MINNEAPOLIS | 67467 | VICTORY | HRW | 68 |
| KS | OAKLEY | 67748 | EAGLE | HRW | 67 |
| KS | OAKLEY | 67748 | EAGLE | HRW | 80 |
| KS | OAKLEY | 67748 | HAWK | HRW | 61 |
| KS | OAKLEY | 67748 | LARNED | HRW | 69 |
| KS | OAKLEY | 67748 | LARNED | HRW | 70 |
| KS | OAKLEY | 67748 | LARNED | HRW | 71 |
| KS | OAKLEY | 67748 | NEWTON | HRW | 62 |
| KS | ONAGA | 66521 | ARKAN | HRW | 62 |
| KS | ONAGA | 66521 | ARKAN | HRW | 66 |
| KS | ONAGA | 66521 | ARKAN | HRW | 66 |
| KS | ONAGA | 66521 | GARST-HR64 | HRW | 62 |
| KS | ONAGA | 66521 | NEWTON | HRW | 58 |
| KS | ONAGA | 66521 | NEWTON | HRW | 61 |
| KS | ONAGA | 66521 | NEWTON | HRW | 62 |
| KS | ONAGA | 66521 | NEWTON | HRW | 76 |
| KS | ONAGA | 66521 | TRAILBLAZER | HRW | 59 |
| KS | ONAGA | 66521 | VICTORY | HRW | 62 |
| KS | OSAGE-CITY | 66523 | ARKAN | HRW | 55 |
| KS | OSAGE-CITY | 66523 | ARKAN | HRW | 60 |
| KS | OSAGE-CITY | 66523 | ARKAN | HRW | 61 |
| KS | OSAGE-CITY | 66523 | ARKAN | HRW | 64 |
| KS | OSAGE-CITY | 66523 | ARKAN | HRW | 67 |
| KS | OSAGE-CITY | 66523 | PRO-BRAND-830 | HRW | 65 |
| KS | OSAGE-CITY | 66523 | SIOUXLAND | HRW | 55 |
| KS | OSAGE-CITY | 66523 | SIOUXLAND | HRW | 57 |
| KS | OSAGE-CITY | 66523 | TAM-105 | HRW | 82 |
| KS | OSAGE-CITY | 66523 | VICTORY | HRW | 55 |
| KS | PARK | 67751 | LARNED | HRW | 65 |
| KS | PARK | 67751 | LARNED | HRW | 71 |
| KS | PARK | 67751 | LARNED | HRW | 74 |
| KS | PARK | 67751 | NEWTON | HRW | 56 |
| KS | PARK | 67751 | NEWTON | HRW | 56 |
| KS | PARK | 67751 | NEWTON | HRW | 57 |
| KS | PARK | 67751 | NEWTON | HRW | 60 |
| KS | PARK | 67751 | TAM-105 | HRW | 70 |
| KS | PARK | 67751 | TAM-107 | HRW | 76 |
| KS | PARK | 67751 | VICTORY | HRW | 74 |
| KS | PHILLIPSBURG | 67661 | ARKAN | HRW | 73 |
| KS | PHILLIPSBURG | 67661 | COLT | HRW | 62 |
| KS | PHILLIPSBURG | 67661 | LARNED | HRW | 68 |
| KS | PHILLIPSBURG | 67661 | MUSTANG | HRW | 66 |
| KS | PHILLIPSBURG | 67661 | NEWTON | HRW | 67 |

TABLE 1. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|--------------|---------|--------------------|-------|----------|
| KS | PHILLIPSBURG | 67661 | NEWTON | HRW | 74 |
| KS | PHILLIPSBURG | 67661 | NORKAN | HRW | 66 |
| KS | PHILLIPSBURG | 67661 | THUNDERBIRD | HRW | 74 |
| KS | PHILLIPSBURG | 67661 | VICTORY | HRW | 74 |
| KS | PHILLIPSBURG | 67661 | VICTORY | HRW | 83 |
| KS | PRESCOTT | 66767 | ARKAN | HRW | 53 |
| KS | PRESCOTT | 66767 | ARKAN | HRW | 56 |
| KS | PRESCOTT | 66767 | McNAIR-1003 | SRW | 25 |
| KS | PRESCOTT | 66767 | PRO-BRAND-830 | HRW | 74 |
| KS | PRESCOTT | 66767 | PRO-BRAND-830 | HRW | 76 |
| KS | PRESCOTT | 66767 | TAM-105 | HRW | 44 |
| KS | PRESCOTT | 66767 | TAM-105 | HRW | 54 |
| KS | PRESCOTT | 66767 | TAM-105 | HRW | 57 |
| KS | PRESCOTT | 66767 | TAM-105 | HRW | 64 |
| KS | PRESCOTT | 66767 | TAM-108 | HRW | 49 |
| KS | RYUS | 67870 | ABILENE | HRW | 76 |
| KS | RYUS | 67870 | GARST-HR48 | HRW | 73 |
| KS | RYUS | 67870 | MESA | HRW | 71 |
| KS | RYUS | 67870 | QUANTUM | HRW | 60 |
| KS | RYUS | 67870 | SCOUT | HRW | 68 |
| KS | RYUS | 67870 | STALLION | HRW | 70 |
| KS | RYUS | 67870 | TAM-107 | HRW | 84 |
| KS | RYUS | 67870 | VICTORY | HRW | 74 |
| KS | SATANTA | 67870 | HAWK | HRW | 77 |
| KS | SATANTA | 67870 | THUNDERBIRD | HRW | 81 |
| KS | SCOTT-CITY | 67871 | LARNED | HRW | 71 |
| KS | SCOTT-CITY | 67871 | LARNED | HRW | 71 |
| KS | SCOTT-CITY | 67871 | MUSTANG | HRW | 63 |
| KS | SCOTT-CITY | 67871 | STALLION | HRW | 66 |
| KS | SEWARD | 67577 | CENTURK-78 | HRW | 64 |
| KS | SEWARD | 67577 | CONCHO | HRW | 66 |
| KS | SEWARD | 67577 | HAWK | HRW | 71 |
| KS | SEWARD | 67577 | NEWTON | HRW | 53 |
| KS | SEWARD | 67577 | NEWTON | HRW | 60 |
| KS | SEWARD | 67577 | NEWTON | HRW | 62 |
| KS | SEWARD | 67577 | NEWTON | HRW | 63 |
| KS | SEWARD | 67577 | TUT | HRW | 67 |
| KS | SEWARD | 67577 | WEATHERMASTER-140A | HRW | 68 |
| KS | ST-JOHN | 67576 | ARKAN | HRW | 61 |
| KS | ST-JOHN | 67576 | HAWK | HRW | 62 |
| KS | ST-JOHN | 67576 | NEWTON | HRW | 61 |
| KS | ST-JOHN | 67576 | TAM-108 | HRW | 60 |
| KS | ST-JOHN | 67576 | VICTORY | HRW | 69 |
| KS | STANTON-CO | 67855 | EAGLE | HRW | 68 |
| KS | STANTON-CO | 67855 | HAWK | HRW | 64 |
| KS | STANTON-CO | 67855 | NEWTON | HRW | 63 |
| KS | STANTON-CO | 67855 | SANDY | HRW | 73 |
| KS | STANTON-CO | 67855 | TAM-105 | HRW | 77 |
| KS | STANTON-CO | 67855 | TAM-106 | HRW | 78 |
| KS | STANTON-CO | 67855 | TAM-107 | HRW | 68 |
| KS | STANTON-CO | 67855 | VONA | HRW | 72 |

TABLE 1. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|-------------|---------|--------------|-------|----------|
| KS | SUBLETTE | 67877 | ABILENE | HRW | 74 |
| KS | SUBLETTE | 67877 | HAWK | HRW | 68 |
| KS | SUBLETTE | 67877 | HAWK | HRW | 73 |
| KS | SUBLETTE | 67877 | HAWK | HRW | 74 |
| KS | SUBLETTE | 67877 | HAWK | HRW | 79 |
| KS | SUBLETTE | 67877 | MESA | HRW | 74 |
| KS | SUBLETTE | 67877 | TAM-107 | HRW | 91 |
| KS | SUBLETTE | 67877 | VICTORY | HRW | 77 |
| KS | TAMPA | 67483 | ARKAN | HRW | 49 |
| KS | TAMPA | 67483 | ARKAN | HRW | 60 |
| KS | TAMPA | 67483 | MUSTANG | HRW | 62 |
| KS | TAMPA | 67483 | NEWTON | HRW | 57 |
| KS | TAMPA | 67483 | NEWTON | HRW | 63 |
| KS | TAMPA | 67483 | PIONEER-2165 | HRW | 67 |
| KS | TAMPA | 67483 | PIONEER-5757 | HRW | 55 |
| KS | TAMPA | 67483 | PIONEER-5757 | HRW | 58 |
| KS | TAMPA | 67483 | VICTORY | HRW | 58 |
| KS | TAMPA | 67483 | VICTORY | HRW | 62 |
| KS | WELLINGTON | 67152 | ARKAN | HRW | 68 |
| KS | WELLINGTON | 67152 | MUSTANG | HRW | 56 |
| KS | WELLINGTON | 67152 | PIONEER-2157 | HRW | 61 |
| KS | WELLINGTON | 67152 | PIONEER-2157 | HRW | 66 |
| KS | WELLINGTON | 67152 | PIONEER-2172 | HRW | 75 |
| KS | WELLINGTON | 67152 | PLAINSMAN | HRW | 67 |
| KS | WELLINGTON | 67152 | STALLION | HRW | 63 |
| KS | WELLINGTON | 67152 | THUNDERBIRD | HRW | 76 |
| KS | WELLINGTON | 67152 | VICTORY | HRW | 59 |
| KS | WHITE-CLOUD | 66094 | AGRI-PRO | HRW | 81 |
| KS | WHITE-CLOUD | 66094 | ARKAN | HRW | 62 |
| KS | WHITE-CLOUD | 66094 | ARKAN | HRW | 67 |
| KS | WHITE-CLOUD | 66094 | NORKAN | HRW | 55 |
| KS | WHITE-CLOUD | 66094 | NORKAN | HRW | 69 |
| KS | WHITE-CLOUD | 66094 | THUNDERBIRD | HRW | 79 |
| KS | WHITE-CLOUD | 66094 | THUNDERBIRD | HRW | 80 |
| KS | WHITE-CLOUD | 66094 | VICTORY | HRW | 65 |
| KS | WHITE-CLOUD | 66094 | VICTORY | HRW | 65 |
| KS | WHITE-CLOUD | 66094 | VICTORY | HRW | 70 |
| MN | ARGYLE | 56713 | MARSHALL | HRS | 74 |
| MN | ARGYLE | 56713 | MARSHALL | HRS | 76 |
| MN | ARGYLE | 56713 | MARSHALL | HRS | 79 |
| MN | ARGYLE | 56713 | MARSHALL | HRS | 83 |
| MN | ARGYLE | 56713 | MARSHALL | HRS | 89 |
| MN | ARGYLE | 56713 | WHEATON | HRS | 69 |
| MN | ARGYLE | 56713 | WHEATON | HRS | 76 |
| MN | ARGYLE | 56713 | WHEATON | HRS | 82 |
| MN | ARGYLE | 56713 | WHEATON | HRS | 87 |
| MN | ARGYLE | 56713 | WHEATON | HRS | 90 |
| MN | CYRUS | 56323 | MARSHALL | HRS | 79 |
| MN | CYRUS | 56323 | PIONEER-2385 | HRS | 76 |
| MN | CYRUS | 56323 | PIONEER-2385 | HRS | 85 |
| MN | CYRUS | 56323 | WHEATON | HRS | 75 |

TABLE 1. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|------------|---------|--------------|-------|----------|
| MN | ELDER | 56523 | MARSHALL | HRS | 75 |
| MN | ELDER | 56523 | MARSHALL | HRS | 77 |
| MN | ELDER | 56523 | MARSHALL | HRS | 81 |
| MN | ELDER | 56523 | MARSHALL | HRS | 83 |
| MN | ELDER | 56523 | MARSHALL | HRS | 83 |
| MN | ELDER | 56523 | MARSHALL | HRS | 85 |
| MN | ELDER | 56523 | MARSHALL | HRS | 86 |
| MN | ELDER | 56523 | MARSHALL | HRS | 87 |
| MN | ELDER | 56523 | MARSHALL | HRS | 94 |
| MN | ELDER | 56523 | PIONEER | HRW | 88 |
| MN | HALLOCK | 56728 | CELTIC | HRS | 81 |
| MN | HALLOCK | 56728 | MARSHALL | HRS | 81 |
| MN | HALLOCK | 56728 | MARSHALL | HRS | 83 |
| MN | HALLOCK | 56728 | MARSHALL | HRS | 83 |
| MN | HALLOCK | 56728 | MARSHALL | HRS | 91 |
| MN | HALLOCK | 56728 | MARSHALL | HRS | 92 |
| MN | HALLOCK | 56728 | MARSHALL | HRS | 97 |
| MN | HALLOCK | 56728 | PIONEER-2369 | HRS | 95 |
| MN | HALLOCK | 56728 | PIONEER-2385 | HRS | 81 |
| MN | HALLOCK | 56728 | STOA | HRS | 86 |
| MN | HANCOCK | 56244 | MARSHALL | HRS | 70 |
| MN | HANCOCK | 56244 | MARSHALL | HRS | 77 |
| MN | HANCOCK | 56244 | MARSHALL | HRS | 79 |
| MN | HAWLEY | 56549 | GUARD | HRS | 75 |
| MN | HAWLEY | 56549 | MARSHALL | HRS | 70 |
| MN | HAWLEY | 56549 | MARSHALL | HRS | 78 |
| MN | HAWLEY | 56549 | MARSHALL | HRS | 80 |
| MN | HAWLEY | 56549 | MARSHALL | HRS | 80 |
| MN | HAWLEY | 56549 | MARSHALL | HRS | 81 |
| MN | HAWLEY | 56549 | MARSHALL | HRS | 86 |
| MN | HAWLEY | 56549 | MARSHALL | HRS | 89 |
| MN | HAWLEY | 56549 | STOA | HRS | 84 |
| MN | HAWLEY | 56549 | STOA | HRS | 84 |
| MN | KARLSTAD | 56732 | BUTTE-86 | HRS | 84 |
| MN | KARLSTAD | 56732 | BUTTE-86 | HRS | 86 |
| MN | KARLSTAD | 56732 | BUTTE-86 | HRS | 87 |
| MN | KARLSTAD | 56732 | BUTTE-86 | HRS | 89 |
| MN | KARLSTAD | 56732 | MARSHALL | HRS | 71 |
| MN | KARLSTAD | 56732 | MARSHALL | HRS | 74 |
| MN | KARLSTAD | 56732 | MARSHALL | HRS | 76 |
| MN | KARLSTAD | 56732 | MARSHALL | HRS | 77 |
| MN | KARLSTAD | 56732 | TELEMARK | HRS | 83 |
| MN | ST-HILAIRE | 56554 | BUTTE-86 | HRS | 87 |
| MN | ST-HILAIRE | 56554 | BUTTE-86 | HRS | 90 |
| MN | ST-HILAIRE | 56554 | GUARD | HRS | 74 |
| MN | ST-HILAIRE | 56554 | MARSHALL | HRS | 78 |
| MN | ST-HILAIRE | 56554 | MARSHALL | HRS | 86 |
| MN | ST-HILAIRE | 56554 | MARSHALL | HRS | 90 |
| MN | ST-HILAIRE | 56554 | NK-711 | HRS | 79 |
| MN | ST-HILAIRE | 56554 | STOA | HRS | 74 |
| MN | ST-HILAIRE | 56554 | STOA | HRS | 77 |

TABLE 1. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|-------------|---------|--------------|-------|----------|
| MN | ST-HILAIRE | 56554 | STOA | HRS | 85 |
| MN | WARROAD | 56763 | MARSHALL | HRS | 61 |
| MN | WARROAD | 56763 | MARSHALL | HRS | 64 |
| MN | WARROAD | 56763 | MARSHALL | HRS | 64 |
| MN | WARROAD | 56763 | MARSHALL | HRS | 68 |
| MN | WARROAD | 56763 | MARSHALL | HRS | 70 |
| MN | WARROAD | 56763 | MARSHALL | HRS | 71 |
| MN | WARROAD | 56763 | MARSHALL | HRS | 71 |
| MN | WARROAD | 56763 | STOA | HRS | 64 |
| MN | WARROAD | 56763 | STOA | HRS | 75 |
| MN | WARROAD | 56763 | STOA | HRS | 77 |
| MO | PETTIS-CO | 65334 | CALDWELL | SRW | 14 |
| MO | PETTIS-CO | 65334 | CALDWELL | SRW | 21 |
| MO | PETTIS-CO | 65334 | PIKE | SRW | 13 |
| MO | SALINE-CO | 65340 | CALDWELL | SRW | 27 |
| MO | SALINE-CO | 65340 | PIKE | SRW | 7 |
| MO | SALINE-CO | 65340 | PIKE | SRW | 13 |
| MO | SALINE-CO | 65340 | PIKE | SRW | 14 |
| MO | SALINE-CO | 65340 | PIKE | SRW | 15 |
| MO | TRENTON | 64683 | CALDWELL | SRW | 25 |
| MO | TRENTON | 64683 | CALDWELL | SRW | 30 |
| MO | TRENTON | 64683 | CALDWELL | SRW | 30 |
| MO | TRENTON | 64683 | CALDWELL | SRW | 31 |
| MO | TRENTON | 64683 | CALDWELL | SRW | 32 |
| MO | TRENTON | 64683 | CALDWELL | SRW | 32 |
| MO | TRENTON | 64683 | GENIE-II | SRW | 29 |
| MO | TRENTON | 64683 | PIKE | SRW | 19 |
| MO | TRENTON | 64683 | PIKE | SRW | 21 |
| MO | WAYLAND | 63472 | AUBURN | SRW | 33 |
| MO | WAYLAND | 63472 | CALDWELL | SRW | 32 |
| MT | BROADVIEW | 59015 | CREE | HRW | 63 |
| MT | CHOTEAU | 59422 | SOLAR-DNS | HRS | 82 |
| MT | DODSON | 59524 | GLENMAN | HRS | 63 |
| MT | DODSON | 59524 | GUERT-2 | HRW | 64 |
| MT | DODSON | 59524 | NEWANA | HRS | 71 |
| MT | DODSON | 59524 | NORSTAR | HRW | 64 |
| MT | DUTTON | 59433 | FORTUNA | HRS | 81 |
| MT | DUTTON | 59433 | GLENMAN | HRS | 81 |
| MT | GREAT-FALLS | 59404 | NEWANA | HRS | 72 |
| MT | GREAT-FALLS | 59404 | NEWANA | HRS | 78 |
| MT | PLENTYWOOD | 59254 | BUTTE-86 | HRS | 88 |
| MT | PLENTYWOOD | 59254 | CUTLESS | HRS | 81 |
| MT | SHELBY | 59474 | GLENMAN | HRS | 81 |
| MT | THREE-FORKS | 59752 | BRONZE-CHIEF | HRS | 72 |
| MT | THREE-FORKS | 59752 | NEWANA | HRS | 79 |
| MT | THREE-FORKS | 59752 | REDWIN | HRW | 82 |
| ND | ALSEN | 58311 | BUTTE-86 | HRS | 90 |
| ND | ALSEN | 58311 | MARSHALL | HRS | 81 |
| ND | ALSEN | 58311 | NORSEMAN | HRS | 104 |
| ND | ALSEN | 58311 | PIONEER-2369 | HRS | 90 |
| ND | ALSEN | 58311 | PIONEER-2385 | HRS | 81 |

TABLE 1. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|------------|---------|---------------|-------|----------|
| ND | ALSEN | 58311 | STOA | HRS | 89 |
| ND | BEULAH | 58523 | ALEX | HRS | 83 |
| ND | BEULAH | 58523 | ALEX | HRS | 85 |
| ND | BEULAH | 58523 | ALEX | HRS | 92 |
| ND | BEULAH | 58523 | COTEAU | HRS | 89 |
| ND | BEULAH | 58523 | MARSHALL | HRS | 85 |
| ND | BEULAH | 58523 | MARSHALL | HRS | 89 |
| ND | BEULAH | 58523 | STOA | HRS | 86 |
| ND | BEULAH | 58523 | STOA | HRS | 90 |
| ND | BEULAH | 58523 | WHEATON | HRS | 76 |
| ND | BINFORD | 58416 | BUTTE | HRS | 96 |
| ND | BINFORD | 58416 | BUTTE-86 | HRS | 76 |
| ND | BINFORD | 58416 | BUTTE-86 | HRS | 90 |
| ND | BINFORD | 58416 | COLUMBUS | HRS | 71 |
| ND | BINFORD | 58416 | COLUMBUS | HRS | 84 |
| ND | BINFORD | 58416 | LEN | HRS | 73 |
| ND | BINFORD | 58416 | LEN | HRS | 81 |
| ND | BINFORD | 58416 | LEN | HRS | 82 |
| ND | BINFORD | 58416 | LEN | HRS | 90 |
| ND | CARRINGTON | 58421 | BUTTE-86 | HRS | 80 |
| ND | CARRINGTON | 58421 | BUTTE-86 | HRS | 84 |
| ND | CARRINGTON | 58421 | BUTTE-86 | HRS | 90 |
| ND | CARRINGTON | 58421 | BUTTE-86 | HRS | 93 |
| ND | CARRINGTON | 58421 | BUTTE-86 | HRS | 93 |
| ND | CARRINGTON | 58421 | BUTTE-86 | HRS | 95 |
| ND | CARRINGTON | 58421 | COLUMBUS | HRS | 87 |
| ND | CARRINGTON | 58421 | COLUMBUS | HRS | 88 |
| ND | CARRINGTON | 58421 | LEN | HRS | 87 |
| ND | CARRINGTON | 58421 | LEN | HRS | 90 |
| ND | CARSON | 58529 | COTEAU | HRS | 91 |
| ND | COLFAX | 58018 | APEX | HRS | 69 |
| ND | COLFAX | 58018 | BUTTE-86 | HRS | 88 |
| ND | COLFAX | 58018 | BUTTE-86 | HRS | 93 |
| ND | COLFAX | 58018 | BUTTE-86 | HRS | 96 |
| ND | COLFAX | 58018 | LEN | HRS | 83 |
| ND | COLFAX | 58018 | MARSHALL | HRS | 82 |
| ND | COLFAX | 58018 | PIONEER-17707 | HRS | 97 |
| ND | COLFAX | 58018 | PIONEER-2385 | HRS | 86 |
| ND | FLASHER | 58535 | COTEAU | HRS | 91 |
| ND | FORMAN | 58032 | BUTTE-86 | HRS | 85 |
| ND | FORMAN | 58032 | BUTTE-86 | HRS | 95 |
| ND | FORMAN | 58032 | STOA | HRS | 77 |
| ND | GRAFTON | 58237 | BUTTE-86 | HRS | 69 |
| ND | GRAFTON | 58237 | BUTTE-86 | HRS | 78 |
| ND | GRAFTON | 58237 | MARSHALL | HRS | 97 |
| ND | GRAFTON | 58237 | NORSEMAN | HRS | 68 |
| ND | GRAFTON | 58237 | NORSEMAN | HRS | 96 |
| ND | GRAFTON | 58237 | NORSEMAN | HRS | 103 |
| ND | GRAFTON | 58237 | STOA | HRS | 84 |
| ND | GRAFTON | 58237 | STOA | HRS | 91 |
| ND | GRAFTON | 58237 | TELEMARK | HRS | 90 |

TABLE 1. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|-----------|---------|--------------|-------|----------|
| ND | GWINNER | 58040 | LEN | HRS | 88 |
| ND | GWINNER | 58040 | STOA | HRS | 94 |
| ND | HUNTER | 58048 | BUTTE-86 | HRS | 83 |
| ND | HUNTER | 58048 | BUTTE-86 | HRS | 94 |
| ND | HUNTER | 58048 | BUTTE-86 | HRS | 97 |
| ND | HUNTER | 58048 | MARSHALL | HRS | 71 |
| ND | HUNTER | 58048 | MARSHALL | HRS | 80 |
| ND | HUNTER | 58048 | STOA | HRS | 79 |
| ND | HUNTER | 58048 | STOA | HRS | 84 |
| ND | HUNTER | 58048 | STOA | HRS | 87 |
| ND | HUNTER | 58048 | STOA | HRS | 93 |
| ND | JAMESTOWN | 58401 | BUTTE-86 | HRS | 88 |
| ND | JAMESTOWN | 58401 | LEN | HRS | 82 |
| ND | JAMESTOWN | 58401 | PIONEER-2385 | HRS | 81 |
| ND | JAMESTOWN | 58401 | STOA | HRS | 82 |
| ND | LARIMORE | 58251 | BUTTE-86 | HRS | 82 |
| ND | LARIMORE | 58251 | CELTIC | HRS | 80 |
| ND | LARIMORE | 58251 | MARSHALL | HRS | 71 |
| ND | LARIMORE | 58251 | MARSHALL | HRS | 76 |
| ND | LARIMORE | 58251 | MARSHALL | HRS | 78 |
| ND | LARIMORE | 58251 | MARSHALL | HRS | 81 |
| ND | LARIMORE | 58251 | PIONEER-2369 | HRS | 90 |
| ND | LARIMORE | 58251 | STOA | HRS | 83 |
| ND | LARK | 58535 | LEN | HRS | 82 |
| ND | LISBON | 58054 | STOA | HRS | 77 |
| ND | NECHE | 58265 | BUTTE-86 | HRS | 91 |
| ND | NECHE | 58265 | BUTTE-86 | HRS | 94 |
| ND | NECHE | 58265 | BUTTE-86 | HRS | 98 |
| ND | NECHE | 58265 | MARSHALL | HRS | 86 |
| ND | NECHE | 58265 | MARSHALL | HRS | 87 |
| ND | NECHE | 58265 | MARSHALL | HRS | 89 |
| ND | NECHE | 58265 | STOA | HRS | 87 |
| ND | NECHE | 58265 | STOA | HRS | 93 |
| ND | RALEIGH | 58564 | 906-R | HRS | 74 |
| ND | RALEIGH | 58564 | COTEAU | HRS | 81 |
| ND | RALEIGH | 58564 | LEN | HRS | 83 |
| ND | RALEIGH | 58564 | STOA | HRS | 70 |
| ND | RALEIGH | 58564 | STOA | HRS | 76 |
| ND | RALEIGH | 58564 | STOA | HRS | 79 |
| ND | RALEIGH | 58564 | STOA | HRS | 79 |
| ND | REGAN | 58477 | COTEAU | HRS | 82 |
| ND | REGAN | 58477 | COTEAU | HRS | 86 |
| ND | REGAN | 58477 | COTEAU | HRS | 87 |
| ND | REGAN | 58477 | COTEAU | HRS | 96 |
| ND | REGAN | 58477 | LEN | HRS | 83 |
| ND | REGAN | 58477 | LEN | HRS | 85 |
| ND | REGAN | 58477 | LEN | HRS | 85 |
| ND | REGAN | 58477 | LEN | HRS | 92 |
| ND | REGAN | 58477 | STOA | HRS | 81 |
| ND | REGAN | 58477 | STOA | HRS | 85 |
| ND | STIRUM | 58069 | BUTTE-86 | HRS | 95 |

TABLE 1. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|----------|---------|------------|-------|----------|
| ND | STIRUM | 58069 | LEN | HRS | 90 |
| ND | TOLLEY | 58787 | ALEX | HRS | 86 |
| ND | TOLLEY | 58787 | BUTTE-86 | HRS | 92 |
| ND | TOLLEY | 58787 | COLUMBUS | HRS | 103 |
| ND | TOLLEY | 58787 | COTEAU | HRS | 93 |
| ND | TOLLEY | 58787 | COTEAU | HRS | 94 |
| ND | TOLLEY | 58787 | LEN | HRS | 83 |
| ND | TOLLEY | 58787 | LEN | HRS | 86 |
| ND | TOLLEY | 58787 | PIONEER | HRW | 89 |
| ND | TOLLEY | 58787 | STOA | HRS | 86 |
| ND | TOLLEY | 58787 | STOA | HRS | 89 |
| ND | WYNDMERE | 58081 | WALDRON | HRS | 95 |
| NE | ALLIANCE | 69301 | BUCKSKIN | HRW | 72 |
| NE | ALLIANCE | 69301 | BUCKSKIN | HRW | 72 |
| NE | ALLIANCE | 69301 | CENTURA | HRW | 51 |
| NE | ALLIANCE | 69301 | CENTURA | HRW | 53 |
| NE | ALLIANCE | 69301 | CENTURA | HRW | 55 |
| NE | ALLIANCE | 69301 | COLT | HRW | 46 |
| NE | ALLIANCE | 69301 | COLT | HRW | 46 |
| NE | ALLIANCE | 69301 | COLT | HRW | 47 |
| NE | ALLIANCE | 69301 | VONA | HRW | 62 |
| NE | ALLIANCE | 69301 | VONA | HRW | 63 |
| NE | CHAPPELL | 69129 | BRULE | HRW | 54 |
| NE | CHAPPELL | 69129 | BRULE | HRW | 55 |
| NE | CHAPPELL | 69129 | BRULE | HRW | 56 |
| NE | CHAPPELL | 69129 | CENTURA | HRW | 59 |
| NE | CHAPPELL | 69129 | CENTURA | HRW | 59 |
| NE | CHAPPELL | 69129 | CENTURA | HRW | 71 |
| NE | CHAPPELL | 69129 | CODY | HRW | 51 |
| NE | CHAPPELL | 69129 | COLT | HRW | 48 |
| NE | CHAPPELL | 69129 | SIOUXLAND | HRW | 59 |
| NE | CHAPPELL | 69129 | VONA | HRW | 53 |
| NE | DALTON | 69131 | HAWK | HRW | 68 |
| NE | DIX | 69133 | CENTURA | HRW | 56 |
| NE | DIX | 69133 | CENTURK-78 | HRW | 70 |
| NE | DIX | 69133 | SCOUT | HRW | 57 |
| NE | DIX | 69133 | SIOUXLAND | HRW | 63 |
| NE | GORDON | 69343 | BRULE | HRW | 61 |
| NE | GORDON | 69343 | CENTURA | HRW | 64 |
| NE | GORDON | 69343 | CODY | HRW | 45 |
| NE | GORDON | 69343 | HAWK | HRW | 52 |
| NE | GORDON | 69343 | HAWK | HRW | 54 |
| NE | GORDON | 69343 | SAGE | HRW | 43 |
| NE | GORDON | 69343 | SCOUT-66 | HRW | 49 |
| NE | GORDON | 69343 | SCOUT-66 | HRW | 51 |
| NE | GORDON | 69343 | SCOUT-66 | HRW | 58 |
| NE | GORDON | 69343 | SCOUT-66 | HRW | 62 |
| NE | GORDON | 69343 | SIOUXLAND | HRW | 45 |
| NE | GORDON | 69343 | SIOUXLAND | HRW | 46 |
| NE | GORDON | 69343 | SIOUXLAND | HRW | 56 |
| NE | GORDON | 69343 | SIOUXLAND | HRW | 59 |

TABLE 1. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|------------|---------|-------------|-------|----------|
| NE | GORDON | 69343 | THUNDERBIRD | HRW | 64 |
| NE | GORDON | 69343 | THUNDERBIRD | HRW | 65 |
| NE | GORDON | 69343 | VONA | HRW | 65 |
| NE | GURLEY | 69141 | BRULE | HRW | 55 |
| NE | GURLEY | 69141 | BRULE | HRW | 69 |
| NE | GURLEY | 69141 | CENTURA | HRW | 62 |
| NE | GURLEY | 69141 | CENTURA | HRW | 63 |
| NE | GURLEY | 69141 | CENTURA | HRW | 72 |
| NE | GURLEY | 69141 | CENTURA | HRW | 73 |
| NE | GURLEY | 69141 | CENTURA | HRW | 79 |
| NE | GURLEY | 69141 | CENTURK | HRW | 57 |
| NE | GURLEY | 69141 | CENTURK-78 | HRW | 64 |
| NE | GURLEY | 69141 | HAWK | HRW | 58 |
| NE | GURLEY | 69141 | HAWK | HRW | 70 |
| NE | GURLEY | 69141 | REDLAND | HRW | 62 |
| NE | GURLEY | 69141 | REDLAND | HRW | 64 |
| NE | HEMINGFORD | 69348 | BRULE | HRW | 58 |
| NE | HEMINGFORD | 69348 | BUCKSKIN | HRW | 70 |
| NE | HEMINGFORD | 69348 | CENTURA | HRW | 73 |
| NE | HEMINGFORD | 69348 | CODY | HRW | 69 |
| NE | HEMINGFORD | 69348 | COLT | HRW | 59 |
| NE | HEMINGFORD | 69348 | LANCER | HRW | 78 |
| NE | HEMINGFORD | 69348 | REDLAND | HRW | 69 |
| NE | HEMINGFORD | 69348 | SIOUXLAND | HRW | 75 |
| NE | HEMINGFORD | 69348 | TAM-107 | HRW | 78 |
| NE | HEMINGFORD | 69348 | VONA | HRW | 69 |
| NE | KIMBALL | 69145 | BRULE | HRW | 69 |
| NE | KIMBALL | 69145 | BUCKSKIN | HRW | 68 |
| NE | KIMBALL | 69145 | CENTURA | HRW | 73 |
| NE | KIMBALL | 69145 | CENTURK | HRW | 76 |
| NE | KIMBALL | 69145 | CODY | HRW | 62 |
| NE | KIMBALL | 69145 | SCOUT-66 | HRW | 63 |
| NE | SIDNEY | 69162 | BRULE | HRW | 59 |
| NE | SIDNEY | 69162 | BRULE | HRW | 63 |
| NE | SIDNEY | 69162 | BRULE | HRW | 64 |
| NE | SIDNEY | 69162 | CENTURA | HRW | 64 |
| NE | SIDNEY | 69162 | CENTURK | HRW | 54 |
| NE | SIDNEY | 69162 | CENTURK-78 | HRW | 73 |
| NE | SIDNEY | 69162 | COLT | HRW | 47 |
| NE | SIDNEY | 69162 | COLT | HRW | 58 |
| NE | SIDNEY | 69162 | HAWK | HRW | 66 |
| NE | SIDNEY | 69162 | LANCER | HRW | 71 |
| NE | SIDNEY | 69162 | ROCKY | HRW | 76 |
| NE | SIDNEY | 69162 | SIOUXLAND | HRW | 61 |
| NE | SIDNEY | 69162 | SIOUXLAND | HRW | 64 |
| NE | SIDNEY | 69162 | SIOUXLAND | HRW | 65 |
| NE | VENANGO | 69168 | CENTURA | HRW | 64 |
| NE | VENANGO | 69168 | CENTURA | HRW | 66 |
| NE | VENANGO | 69168 | CHEYENNE | HRW | 61 |
| NE | VENANGO | 69168 | CODY | HRW | 60 |
| NE | VENANGO | 69168 | COLT | HRW | 62 |

TABLE 1. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDN |
|-------|---------------|---------|--------------|-------|-------|
| NE | VENANGO | 69168 | NORKAN | HRW | 59 |
| NE | VENANGO | 69168 | REDLAND | HRW | 47 |
| NE | VENANGO | 69168 | TAM-107 | HRW | 73 |
| NE | VENANGO | 69168 | TAM-107 | HRW | 77 |
| NE | VENANGO | 69168 | TAM-107 | HRW | 81 |
| OH | BUTLER | 44822 | CALDWELL | SRW | 25 |
| OH | BUTLER | 44822 | CALDWELL | SRW | 27 |
| OH | BUTLER | 44822 | PIONEER | SRW | 20 |
| OH | COLUMBUS | 43201 | BECKER | SRW | 23 |
| OH | COLUMBUS | 43201 | HART | SRW | 30 |
| OH | COLUMBUS | 43201 | TITAN | SRW | 30 |
| OH | CROTON | 43013 | CALDWELL | SRW | 22 |
| OH | DELAWARE | 43015 | PIONEER-2550 | SRW | 22 |
| OH | LANCASTER | 43130 | SCOTTY | SRW | 28 |
| OH | MAHONING | 44609 | LOGAN | SRW | 26 |
| OH | NEWARK | 43093 | CALDWELL | SRW | 29 |
| OH | PATASKALA | 43062 | CALDWELL | SRW | 29 |
| OH | PICKERINGTON | 43147 | BECKER | SRW | 17 |
| OH | PLEASANTVILLE | 43148 | PIONEER | SRW | 32 |
| OH | PORTAGE | 43451 | LOGAN | SRW | 24 |
| OH | PORTAGE | 43451 | PIONEER | SRW | 23 |
| OH | PREBLE | 45347 | CARDINAL | SRW | 22 |
| OH | PREBLE | 45347 | CARDINAL | SRW | 24 |
| OH | S-CHARLESTON | 45368 | 40A-DYNASTY | SRW | 22 |
| OH | S-CHARLESTON | 45368 | BECKER | SRW | 20 |
| OH | S-CHARLESTON | 45368 | BECKER | SRW | 21 |
| OH | S-CHARLESTON | 45368 | CALDWELL | SRW | 26 |
| OH | S-CHARLESTON | 45368 | CALDWELL | SRW | 28 |
| OH | S-CHARLESTON | 45368 | CALDWELL | SRW | 31 |
| OH | S-CHARLESTON | 45368 | CARDINAL | SRW | 21 |
| OH | S-CHARLESTON | 45368 | CARDINAL | SRW | 23 |
| OH | S-CHARLESTON | 45368 | DYNASTY | SRW | 23 |
| OH | S-CHARLESTON | 45368 | FS402 | SRW | 25 |
| OH | S-CHARLESTON | 45368 | FS402 | SRW | 25 |
| OH | S-CHARLESTON | 45368 | GR860 | SRW | 25 |
| OH | S-CHARLESTON | 45368 | GR860 | SRW | 25 |
| OH | S-CHARLESTON | 45368 | GR876 | SRW | 26 |
| OH | S-CHARLESTON | 45368 | GR876 | SRW | 30 |
| OH | WINCHESTER | 45697 | BECKER | SRW | 24 |
| OK | AFTON | 74331 | ARKAN | HRW | 59 |
| OK | AFTON | 74331 | CALDWELL | SRW | 32 |
| OK | AFTON | 74331 | CHISHOLM | HRW | 44 |
| OK | AFTON | 74331 | CHISHOLM | HRW | 45 |
| OK | AFTON | 74331 | CHISHOLM | HRW | 45 |
| OK | AFTON | 74331 | CHISHOLM | HRW | 49 |
| OK | AFTON | 74331 | CHISHOLM | HRW | 49 |
| OK | AFTON | 74331 | CHISHOLM | HRW | 50 |
| OK | AFTON | 74331 | CHISHOLM | HRW | 52 |
| OK | AFTON | 74331 | CHISHOLM | HRW | 52 |
| OK | AFTON | 74331 | CHISHOLM | HRW | 56 |
| OK | AFTON | 74331 | CHISHOLM | HRW | 64 |

TABLE 1. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|-----------|---------|--------------|-------|----------|
| OK | AFTON | 74331 | PIONEER | HRW | 66 |
| OK | AFTON | 74331 | PIONEER | HRW | 72 |
| OK | AFTON | 74331 | PIONEER-2157 | HRW | 50 |
| OK | AFTON | 74331 | PIONEER-2157 | HRW | 51 |
| OK | AFTON | 74331 | WRANGLER | HRW | 63 |
| OK | AFTON | 74331 | WRANGLER | HRW | 66 |
| OK | BISON | 73720 | CHISHOLM | HRW | 36 |
| OK | BISON | 73720 | CHISHOLM | HRW | 40 |
| OK | BISON | 73720 | CHISHOLM | HRW | 41 |
| OK | BISON | 73720 | CHISHOLM | HRW | 41 |
| OK | BISON | 73720 | CHISHOLM | HRW | 43 |
| OK | BISON | 73720 | CHISHOLM | HRW | 43 |
| OK | BISON | 73720 | CHISHOLM | HRW | 44 |
| OK | BISON | 73720 | CHISHOLM | HRW | 44 |
| OK | BISON | 73720 | CHISHOLM | HRW | 46 |
| OK | BISON | 73720 | CHISHOLM | HRW | 48 |
| OK | BISON | 73720 | PIONEER-2157 | HRW | 60 |
| OK | BISON | 73720 | PIONEER-2157 | HRW | 60 |
| OK | BISON | 73720 | PIONEER-2157 | HRW | 64 |
| OK | BISON | 73720 | PIONEER-2157 | HRW | 66 |
| OK | BISON | 73720 | PIONEER-2157 | HRW | 67 |
| OK | BISON | 73720 | TRIUMPH | HRW | 47 |
| OK | BISON | 73720 | TRIUMPH | HRW | 52 |
| OK | BISON | 73720 | TRIUMPH | HRW | 53 |
| OK | BISON | 73720 | TRIUMPH | HRW | 54 |
| OK | BISON | 73720 | TRIUMPH | HRW | 56 |
| OK | CHICKASHA | 73015 | CHISHOLM | HRW | 41 |
| OK | CHICKASHA | 73015 | CHISHOLM | HRW | 43 |
| OK | CHICKASHA | 73015 | CHISHOLM | HRW | 43 |
| OK | CHICKASHA | 73015 | CHISHOLM | HRW | 45 |
| OK | CHICKASHA | 73015 | CHISHOLM | HRW | 47 |
| OK | CHICKASHA | 73015 | CHISHOLM | HRW | 47 |
| OK | CHICKASHA | 73015 | CHISHOLM | HRW | 47 |
| OK | CHICKASHA | 73015 | CHISHOLM | HRW | 48 |
| OK | CHICKASHA | 73015 | CHISHOLM | HRW | 50 |
| OK | CHICKASHA | 73015 | CHISHOLM | HRW | 52 |
| OK | CHICKASHA | 73015 | CHISHOLM | HRW | 52 |
| OK | CHICKASHA | 73015 | PIONEER-2157 | HRW | 54 |
| OK | CHICKASHA | 73015 | PIONEER-2157 | HRW | 58 |
| OK | CHICKASHA | 73015 | PIONEER-2157 | HRW | 58 |
| OK | CHICKASHA | 73015 | PIONEER-2157 | HRW | 62 |
| OK | CHICKASHA | 73015 | PIONEER-2157 | HRW | 64 |
| OK | CHICKASHA | 73015 | VONA | HRW | 46 |
| OK | CHICKASHA | 73015 | VONA | HRW | 50 |
| OK | CHICKASHA | 73015 | VONA | HRW | 55 |
| OK | CHICKASHA | 73015 | VONA | HRW | 57 |
| OK | CHICKASHA | 73015 | VONA | HRW | 60 |
| OK | FREDERICK | 73542 | CHISHOLM | HRW | 40 |
| OK | FREDERICK | 73542 | CHISHOLM | HRW | 41 |
| OK | FREDERICK | 73542 | CHISHOLM | HRW | 43 |
| OK | FREDERICK | 73542 | CHISHOLM | HRW | 43 |
| OK | FREDERICK | 73542 | CHISHOLM | HRW | 44 |

TABLE 1. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|------------|---------|--------------|-------|----------|
| OK | FREDERICK | 73542 | CHISHOLM | HRW | 44 |
| OK | FREDERICK | 73542 | CHISHOLM | HRW | 44 |
| OK | FREDERICK | 73542 | CHISHOLM | HRW | 44 |
| OK | FREDERICK | 73542 | NK-812 | HRW | 79 |
| OK | FREDERICK | 73542 | NK-812 | HRW | 85 |
| OK | KINGFISHER | 73750 | CHISHOLM | HRW | 35 |
| OK | KINGFISHER | 73750 | CHISHOLM | HRW | 38 |
| OK | KINGFISHER | 73750 | CHISHOLM | HRW | 38 |
| OK | KINGFISHER | 73750 | CHISHOLM | HRW | 41 |
| OK | KINGFISHER | 73750 | CHISHOLM | HRW | 42 |
| OK | KINGFISHER | 73750 | CHISHOLM | HRW | 44 |
| OK | KINGFISHER | 73750 | CHISHOLM | HRW | 44 |
| OK | KINGFISHER | 73750 | CHISHOLM | HRW | 45 |
| OK | KINGFISHER | 73750 | CHISHOLM | HRW | 50 |
| OK | KINGFISHER | 73750 | CHISHOLM | HRW | 59 |
| OK | KINGFISHER | 73750 | PIONEER | HRW | 61 |
| OK | KINGFISHER | 73750 | PIONEER | HRW | 61 |
| OK | KINGFISHER | 73750 | PIONEER-2157 | HRW | 58 |
| OK | KINGFISHER | 73750 | PIONEER-2157 | HRW | 61 |
| OK | KINGFISHER | 73750 | PIONEER-2157 | HRW | 61 |
| OK | KINGFISHER | 73750 | TAM-101 | HRW | 58 |
| OK | KINGFISHER | 73750 | TAM-101 | HRW | 58 |
| OK | KINGFISHER | 73750 | TAM-101 | HRW | 63 |
| OK | KINGFISHER | 73750 | TRIUMPH | HRW | 55 |
| OK | MEDFORD | 73759 | CHISHOLM | HRW | 42 |
| OK | MEDFORD | 73759 | CHISHOLM | HRW | 45 |
| OK | MEDFORD | 73759 | CHISHOLM | HRW | 48 |
| OK | MEDFORD | 73759 | PIONEER-2157 | HRW | 50 |
| OK | MEDFORD | 73759 | PIONEER-2157 | HRW | 57 |
| OK | MEDFORD | 73759 | PIONEER-2157 | HRW | 57 |
| OK | MEDFORD | 73759 | PIONEER-2157 | HRW | 60 |
| OK | MEDFORD | 73759 | PIONEER-2157 | HRW | 64 |
| OK | MEDFORD | 73759 | PIONEER-2157 | HRW | 66 |
| OK | MEDFORD | 73759 | STALLION | HRW | 65 |
| OK | PONCA-CITY | 74601 | CHISHOLM | HRW | 36 |
| OK | PONCA-CITY | 74601 | CHISHOLM | HRW | 40 |
| OK | PONCA-CITY | 74601 | CHISHOLM | HRW | 40 |
| OK | PONCA-CITY | 74601 | CHISHOLM | HRW | 41 |
| OK | PONCA-CITY | 74601 | CHISHOLM | HRW | 41 |
| OK | PONCA-CITY | 74601 | CHISHOLM | HRW | 42 |
| OK | PONCA-CITY | 74601 | CHISHOLM | HRW | 43 |
| OK | PONCA-CITY | 74601 | CHISHOLM | HRW | 44 |
| OK | PONCA-CITY | 74601 | CHISHOLM | HRW | 48 |
| OK | PONCA-CITY | 74601 | CHISHOLM | HRW | 51 |
| OK | PONCA-CITY | 74601 | MUSTANG | HRW | 60 |
| OK | PONCA-CITY | 74601 | MUSTANG | HRW | 65 |
| OK | PONCA-CITY | 74601 | MUSTANG | HRW | 66 |
| OK | PONCA-CITY | 74601 | MUSTANG | HRW | 66 |
| OK | PONCA-CITY | 74601 | PIONEER | HRW | 49 |
| OK | PONCA-CITY | 74601 | PIONEER | HRW | 58 |
| OK | PONCA-CITY | 74601 | PIONEER-2157 | HRW | 54 |

TABLE 1. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|-------------|---------|--------------|-------|----------|
| OK | PONCA-CITY | 74601 | PIONEER-2157 | HRW | 60 |
| OK | PONCA-CITY | 74601 | PIONEER-2157 | HRW | 61 |
| OK | PONCA-CITY | 74601 | PIONEER-2157 | HRW | 63 |
| OK | STILLWATER | 74076 | CHISHOLM | HRW | 33 |
| OK | STILLWATER | 74076 | CHISHOLM | HRW | 38 |
| OK | STILLWATER | 74076 | CHISHOLM | HRW | 40 |
| OK | STILLWATER | 74076 | CHISHOLM | HRW | 42 |
| OK | STILLWATER | 74076 | CHISHOLM | HRW | 42 |
| OK | STILLWATER | 74076 | CHISHOLM | HRW | 43 |
| OK | STILLWATER | 74076 | CHISHOLM | HRW | 43 |
| OK | STILLWATER | 74076 | CHISHOLM | HRW | 44 |
| OK | STILLWATER | 74076 | CHISHOLM | HRW | 50 |
| OK | STILLWATER | 74076 | CHISHOLM | HRW | 67 |
| OK | STILLWATER | 74076 | CONCHO | HRW | 36 |
| OK | STILLWATER | 74076 | CONCHO | HRW | 39 |
| OK | STILLWATER | 74076 | CONCHO | HRW | 39 |
| OK | STILLWATER | 74076 | CONCHO | HRW | 40 |
| OK | STILLWATER | 74076 | CONCHO | HRW | 40 |
| OK | STILLWATER | 74076 | PIONEER-2157 | HRW | 56 |
| OK | STILLWATER | 74076 | PIONEER-2157 | HRW | 60 |
| OK | STILLWATER | 74076 | PIONEER-2157 | HRW | 61 |
| OK | STILLWATER | 74076 | PIONEER-2157 | HRW | 62 |
| OK | STILLWATER | 74076 | PIONEER-2157 | HRW | 62 |
| OK | WEATHERFORD | 73096 | CHISHOLM | HRW | 40 |
| OK | WEATHERFORD | 73096 | CHISHOLM | HRW | 42 |
| OK | WEATHERFORD | 73096 | CHISHOLM | HRW | 43 |
| OK | WEATHERFORD | 73096 | CHISHOLM | HRW | 43 |
| OK | WEATHERFORD | 73096 | CHISHOLM | HRW | 47 |
| OK | WEATHERFORD | 73096 | CHISHOLM | HRW | 50 |
| OK | WEATHERFORD | 73096 | CHISHOLM | HRW | 51 |
| OK | WEATHERFORD | 73096 | CHISHOLM | HRW | 51 |
| OK | WEATHERFORD | 73096 | CHISHOLM | HRW | 52 |
| OK | WEATHERFORD | 73096 | CHISHOLM | HRW | 53 |
| OK | WEATHERFORD | 73096 | MUSTANG | HRW | 52 |
| OK | WEATHERFORD | 73096 | MUSTANG | HRW | 61 |
| OK | WEATHERFORD | 73096 | PIONEER-2157 | HRW | 47 |
| OK | WEATHERFORD | 73096 | PIONEER-2157 | HRW | 58 |
| OK | WEATHERFORD | 73096 | PIONEER-2157 | HRW | 64 |
| OK | WEATHERFORD | 73096 | PIONEER-2157 | HRW | 66 |
| OK | WEATHERFORD | 73096 | PIONEER-2157 | HRW | 69 |
| OK | WEATHERFORD | 73096 | TRIUMPH | HRW | 46 |
| OK | WEATHERFORD | 73096 | TRIUMPH | HRW | 51 |
| OK | WEATHERFORD | 73096 | TRIUMPH | HRW | 54 |
| OK | WOODWARD | 73801 | CHISHOLM | HRW | 34 |
| OK | WOODWARD | 73801 | CHISHOLM | HRW | 40 |
| OK | WOODWARD | 73801 | CHISHOLM | HRW | 41 |
| OK | WOODWARD | 73801 | CHISHOLM | HRW | 49 |
| OK | WOODWARD | 73801 | CHISHOLM | HRW | 60 |
| OK | WOODWARD | 73801 | CHISHOLM | HRW | 71 |
| OK | WOODWARD | 73801 | PIONEER-2157 | HRW | 49 |
| OK | WOODWARD | 73801 | PIONEER-2157 | HRW | 54 |

TABLE 1. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNES |
|-------|----------|---------|--------------|-------|---------|
| OK | WOODWARD | 73801 | PIONEER-2157 | HRW | 58 |
| OK | WOODWARD | 73801 | PIONEER-2157 | HRW | 62 |
| OK | WOODWARD | 73801 | PIONEER-2157 | HRW | 72 |
| OK | WOODWARD | 73801 | SIOUXLAND | HRW | 59 |
| OK | WOODWARD | 73801 | SIOUXLAND | HRW | 59 |
| OK | WOODWARD | 73801 | SIOUXLAND | HRW | 60 |
| OK | WOODWARD | 73801 | SIOUXLAND | HRW | 67 |
| OK | WOODWARD | 73802 | CHISHOLM | HRW | 40 |
| OK | WOODWARD | 73802 | CHISHOLM | HRW | 43 |
| OK | WOODWARD | 73802 | CHISHOLM | HRW | 44 |
| OK | WOODWARD | 73802 | CHISHOLM | HRW | 58 |
| OK | WOODWARD | 73802 | SIOUXLAND | HRW | 64 |

TABLE 2. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|----------------|---------|----------------------|-------|----------|
| KS | ALTA-VISTA | 66834 | ARKAN | HRW | 61 |
| KS | ALTA-VISTA | 66834 | NORKAN | HRW | 64 |
| KS | ARKANSAS-CITY | 67005 | ARKAN | HRW | 60 |
| KS | ARKANSAS-CITY | 67005 | ARKAN | HRW | 67 |
| KS | BELLE-PLAINE | 67013 | MESA | HRW | 59 |
| KS | BELLE-PLAINE | 67013 | MESA | HRW | 62 |
| KS | BELLE-PLAINE | 67013 | VICTORY | HRW | 57 |
| KS | BELOIT | 67420 | ARKAN | HRW | 66 |
| KS | BELOIT | 67420 | NORKAN | HRW | 65 |
| KS | BELVUE | 66407 | TAM-107 | HRW | 81 |
| KS | BISON | 67520 | MESA | HRW | 76 |
| KS | BONNER-SPRINGS | 66012 | ARKAN | HRW | 63 |
| KS | BONNER-SPRINGS | 66012 | ARKAN | HRW | 64 |
| KS | BONNER-SPRINGS | 66012 | DODGE | HRW | 68 |
| KS | BONNER-SPRINGS | 66012 | NEWTON | HRW | 58 |
| KS | BONNER-SPRINGS | 66012 | NEWTON | HRW | 60 |
| KS | BROWN-CO | 66434 | ABILENE-DRYLAND | HRW | 63 |
| KS | BROWN-CO | 66434 | ARKAN-DRYLAND | HRW | 50 |
| KS | BROWN-CO | 66434 | BH-122-DRYLAND | HRW | 55 |
| KS | BROWN-CO | 66434 | BH-203A-DRYLAND | HRW | 38 |
| KS | BROWN-CO | 66434 | CALDWELL-DRYLAND | SRW | 25 |
| KS | BROWN-CO | 66434 | CENTURA-DRYLAND | HRW | 62 |
| KS | BROWN-CO | 66434 | CENTURY-DRYLAND | HRW | 61 |
| KS | BROWN-CO | 66434 | CHISHOLM-DRYLAND | HRW | 42 |
| KS | BROWN-CO | 66434 | COLT-DRYLAND | HRW | 51 |
| KS | BROWN-CO | 66434 | COMPTON-DRYLAND | SRW | 20 |
| KS | BROWN-CO | 66434 | DELANGE-7837-DRYLAND | HRW | 52 |
| KS | BROWN-CO | 66434 | DELANGE-7846-DRYLAND | HRW | 50 |
| KS | BROWN-CO | 66434 | DODGE-DRYLAND | HRW | 54 |
| KS | BROWN-CO | 66434 | KARL-DRYLAND | HRW | 56 |
| KS | BROWN-CO | 66434 | LARNED-DRYLAND | HRW | 61 |
| KS | BROWN-CO | 66434 | MESA-DRYLAND | HRW | 52 |
| KS | BROWN-CO | 66434 | MO-9965-DRYLAND | SRW | |

TABLE 2. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNE |
|-------|------------|---------|-----------------------|-------|--------|
| KS | BROWN-CO | 66434 | W85-120-EXP-DRYLAND | HRW | 64 |
| KS | BURDETT | 67523 | TAM-107 | HRW | 71 |
| KS | BURLINGAME | 66413 | NORKAN | HRW | 64 |
| KS | BURLINGAME | 66413 | SIOUXLAND | HRW | 60 |
| KS | CANEY | 67333 | ARKAN | HRW | 56 |
| KS | CHASE | 67524 | MESA | HRW | 69 |
| KS | CIMMERON | 67835 | LARNED | HRW | 69 |
| KS | CIMMERON | 67835 | NEWTON | HRW | 70 |
| KS | DELIA | 66418 | ARKAN | HRW | 62 |
| KS | DERBY | 67037 | THUNDERBIRD | HRW | 60 |
| KS | ELLIS-CO | 67601 | ABILENE-DRYLAND | HRW | 67 |
| KS | ELLIS-CO | 67601 | ARKAN-DRYLAND | HRW | 65 |
| KS | ELLIS-CO | 67601 | CHISHOLM-DRYLAND | HRW | 42 |
| KS | ELLIS-CO | 67601 | CODY-DRYLAND | HRW | 77 |
| KS | ELLIS-CO | 67601 | DELANGE-7837-DRYLAND | HRW | 61 |
| KS | ELLIS-CO | 67601 | DODGE-DRYLAND | HRW | 78 |
| KS | ELLIS-CO | 67601 | KS84HW196-EXP-DRYLAND | HRW | 63 |
| KS | ELLIS-CO | 67601 | MESA-DRYLAND | HRW | 75 |
| KS | ELLIS-CO | 67601 | MUSTANG-DRYLAND | HRW | 69 |
| KS | ELLIS-CO | 67601 | NEWTON-DRYLAND | HRW | 63 |
| KS | ELLIS-CO | 67601 | NORKAN-DRYLAND | HRW | 68 |
| KS | ELLIS-CO | 67601 | PIONEER-2154-DRYLAND | HRW | 81 |
| KS | ELLIS-CO | 67601 | PIONEER-2157-DRYLAND | HRW | 59 |
| KS | ELLIS-CO | 67601 | PIONEER-2172-DRYLAND | HRW | 79 |
| KS | ELLIS-CO | 67601 | QUANTUM-562-DRYLAND | HRW | 63 |
| KS | ELLIS-CO | 67601 | RIO-BLANCO-DRYLAND | HRW | 63 |
| KS | ELLIS-CO | 67601 | SIOUXLAND-DRYLAND | HRW | 69 |
| KS | ELLIS-CO | 67601 | TAM-105-DRYLAND | HRW | 69 |
| KS | ELLIS-CO | 67601 | TAM-107-DRYLAND | HRW | 73 |
| KS | ELLIS-CO | 67601 | TAM-108-DRYLAND | HRW | 67 |
| KS | ELLIS-CO | 67601 | TAM-200-DRYLAND | HRW | 60 |
| KS | ELLIS-CO | 67601 | THUNDERBIRD-DRYLAND | HRW | 80 |
| KS | ELLIS-CO | 67601 | VICTORY-DRYLAND | HRW | 67 |
| KS | EVEREST | 66424 | ABILENE | HRW | 70 |
| KS | EVEREST | 66424 | ABILENE | HRW | 71 |
| KS | FINNEY-CO | 67846 | ABILENE-DRYLAND | HRW | 71 |
| KS | FINNEY-CO | 67846 | ABILENE-IRRIGATED | HRW | 60 |
| KS | FINNEY-CO | 67846 | ARKAN-DRYLAND | HRW | 61 |
| KS | FINNEY-CO | 67846 | ARKAN-IRRIGATED | HRW | 64 |
| KS | FINNEY-CO | 67846 | BH-122-DRYLAND | HRW | 60 |
| KS | FINNEY-CO | 67846 | BH-122-IRRIGATED | HRW | 55 |
| KS | FINNEY-CO | 67846 | BH-203A-DRYLAND | HRW | 44 |
| KS | FINNEY-CO | 67846 | BH-203A-IRRIGATED | HRW | 47 |
| KS | FINNEY-CO | 67846 | BRONCO-DRYLAND | HRW | 62 |
| KS | FINNEY-CO | 67846 | CENTURY-DRYLAND | HRW | 71 |
| KS | FINNEY-CO | 67846 | CENTURY-IRRIGATED | HRW | 62 |
| KS | FINNEY-CO | 67846 | CHISHOLM-DRYLAND | HRW | 46 |
| KS | FINNEY-CO | 67846 | DELANGE-7837-DRYLAND | HRW | 72 |
| KS | FINNEY-CO | 67846 | DELANGE-7846-DRYLAND | HRW | 61 |
| KS | FINNEY-CO | 67846 | DODGE-DRYLAND | HRW | 69 |
| KS | FINNEY-CO | 67846 | DODGE-IRRIGATED | HRW | 66 |

TABLE 2. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|-------------|---------|-------------------------|-------|----------|
| KS | FINNEY-CO | 67846 | KARL-DRYLAND | HRW | 73 |
| KS | FINNEY-CO | 67846 | KARL-IRRIGATED | HRW | 63 |
| KS | FINNEY-CO | 67846 | KS84HW196-EXP-DRYLAND | HWW | 62 |
| KS | FINNEY-CO | 67846 | KS84HW196-EXP-IRRIGATED | HWW | 68 |
| KS | FINNEY-CO | 67846 | LARNED-DRYLAND | HRW | 67 |
| KS | FINNEY-CO | 67846 | MUSTANG-DRYLAND | HRW | 62 |
| KS | FINNEY-CO | 67846 | MUSTANG-IRRIGATED | HRW | 62 |
| KS | FINNEY-CO | 67846 | NEWTON-DRYLAND | HRW | 63 |
| KS | FINNEY-CO | 67846 | NEWTON-IRRIGATED | HRW | 54 |
| KS | FINNEY-CO | 67846 | NORKAN-DRYLAND | HRW | 64 |
| KS | FINNEY-CO | 67846 | NORKAN-IRRIGATED | HRW | 61 |
| KS | FINNEY-CO | 67846 | PIONEER-2154-DRYLAND | HRW | 77 |
| KS | FINNEY-CO | 67846 | PIONEER-2157-IRRIGATED | HRW | 58 |
| KS | FINNEY-CO | 67846 | PIONEER-2172-DRYLAND | HRW | 74 |
| KS | FINNEY-CO | 67846 | PIONEER-2172-IRRIGATED | HRW | 75 |
| KS | FINNEY-CO | 67846 | QUANTUM-578-DRYLAND | HRW | 64 |
| KS | FINNEY-CO | 67846 | QUANTUM-578-IRRIGATED | HRW | 57 |
| KS | FINNEY-CO | 67846 | REDLAND-DRYLAND | HRW | 64 |
| KS | FINNEY-CO | 67846 | RIO-BLANCO-DRYLAND | HWW | 62 |
| KS | FINNEY-CO | 67846 | RIO-BLANCO-IRRIGATED | HWW | 59 |
| KS | FINNEY-CO | 67846 | SCOUT-66-DRYLAND | HRW | 69 |
| KS | FINNEY-CO | 67846 | SIOUXLAND-DRYLAND | HRW | 73 |
| KS | FINNEY-CO | 67846 | SIOUXLAND-IRRIGATED | HRW | 62 |
| KS | FINNEY-CO | 67846 | STALLION-IRRIGATED | HRW | 61 |
| KS | FINNEY-CO | 67846 | STAR-SEED-830-IRRIGATED | HRW | 73 |
| KS | FINNEY-CO | 67846 | TAM-105-DRYLAND | HRW | 76 |
| KS | FINNEY-CO | 67846 | TAM-105-IRRIGATED | HRW | 66 |
| KS | FINNEY-CO | 67846 | TAM-107-DRYLAND | HRW | 74 |
| KS | FINNEY-CO | 67846 | TAM-107-IRRIGATED | HRW | 69 |
| KS | FINNEY-CO | 67846 | TAM-108-DRYLAND | HRW | 59 |
| KS | FINNEY-CO | 67846 | TAM-108-IRRIGATED | HRW | 47 |
| KS | FINNEY-CO | 67846 | TAM-200-IRRIGATED | HRW | 59 |
| KS | FINNEY-CO | 67846 | THUNDERBIRD-DRYLAND | HRW | 71 |
| KS | FINNEY-CO | 67846 | THUNDERBIRD-IRRIGATED | HRW | 69 |
| KS | FINNEY-CO | 67846 | VICTORY-DRYLAND | HRW | 68 |
| KS | FINNEY-CO | 67846 | VICTORY-IRRIGATED | HRW | 61 |
| KS | FRANKLIN-CO | 66067 | ABILENE-DRYLAND | HRW | 62 |
| KS | FRANKLIN-CO | 66067 | ARKAN-DRYLAND | HRW | 58 |
| KS | FRANKLIN-CO | 66067 | BECKER-DRYLAND | SRW | 17 |
| KS | FRANKLIN-CO | 66067 | BH-122-DRYLAND | HRW | 59 |
| KS | FRANKLIN-CO | 66067 | CALDWELL-DRYLAND | SRW | 21 |
| KS | FRANKLIN-CO | 66067 | CENTURA-DRYLAND | HRW | 72 |
| KS | FRANKLIN-CO | 66067 | CENTURY-DRYLAND | HRW | 57 |
| KS | FRANKLIN-CO | 66067 | CHISHOLM-DRYLAND | HRW | 44 |
| KS | FRANKLIN-CO | 66067 | COMPTON-DRYLAND | SRW | 22 |
| KS | FRANKLIN-CO | 66067 | DELANGE-7837-DRYLAND | HRW | 56 |
| KS | FRANKLIN-CO | 66067 | DELANGE-7846-DRYLAND | HRW | 52 |
| KS | FRANKLIN-CO | 66067 | DODGE-DRYLAND | HRW | 56 |
| KS | FRANKLIN-CO | 66067 | LARNED-DRYLAND | HRW | 68 |
| KS | FRANKLIN-CO | 66067 | MESA-DRYLAND | HRW | 60 |
| KS | FRANKLIN-CO | 66067 | MO-9965-EXP-DRYLAND | SRW | 15 |

TABLE 2. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|-------------|---------|----------------------|-------|----------|
| KS | FRANKLIN-CO | 66067 | NEWTON-DRYLAND | HRW | 53 |
| KS | FRANKLIN-CO | 66067 | NORKAN | HRW | 56 |
| KS | FRANKLIN-CO | 66067 | PIONEER-2154 | HRW | 71 |
| KS | FRANKLIN-CO | 66067 | PIONEER-2551 | SRW | 23 |
| KS | FRANKLIN-CO | 66067 | RIO-BLANCO-DRYLAND | HWW | 61 |
| KS | FRANKLIN-CO | 66067 | SCOUT-66 | HRW | 63 |
| KS | FRANKLIN-CO | 66067 | SIOUXLAND | HRW | 60 |
| KS | FRANKLIN-CO | 66067 | TAM-105 | HRW | 63 |
| KS | FRANKLIN-CO | 66067 | TAM-107 | HRW | 71 |
| KS | FRANKLIN-CO | 66067 | TAM-108 | HRW | 49 |
| KS | FRANKLIN-CO | 66067 | THUNDERBIRD-DRYLAND | HRW | 66 |
| KS | FRANKLIN-CO | 66067 | VICTORY-DRYLAND | HRW | 63 |
| KS | FRANKLIN-CO | 66067 | W85-120-EXP-DRYLAND | HRW | 67 |
| KS | GARDEN-CITY | 67846 | MESA | HRW | 75 |
| KS | GARDEN-CITY | 67846 | MESA | HRW | 75 |
| KS | GARDEN-CITY | 67846 | TAM-107 | HRW | 82 |
| KS | GARDEN-CITY | 67846 | THUNDERBIRD | HRW | 67 |
| KS | GARDEN-CITY | 67846 | THUNDERBIRD | HRW | 80 |
| KS | GARDEN-CITY | 67846 | THUNDERBIRD | HRW | 81 |
| KS | GARDEN-CITY | 67846 | VICTORY | HRW | 78 |
| KS | GIRARD | 66743 | MESA | HRW | 64 |
| KS | GIRARD | 66743 | THUNDERBIRD | HRW | 71 |
| KS | GREELEY | 66033 | ABILENE | HRW | 77 |
| KS | GREELEY | 66033 | SIOUXLAND | HRW | 59 |
| KS | GREELEY | 66033 | THUNDERBIRD | HRW | 67 |
| KS | GREELEY-CO | 67879 | ABILENE-DRYLAND | HRW | 59 |
| KS | GREELEY-CO | 67879 | ABILENE-DRYLAND | HRW | 72 |
| KS | GREELEY-CO | 67879 | ARKAN-DRYLAND | HRW | 61 |
| KS | GREELEY-CO | 67879 | ARKAN-IRRIGATED | HRW | 59 |
| KS | GREELEY-CO | 67879 | BRONCO-DRYLAND | HRW | 63 |
| KS | GREELEY-CO | 67879 | CARSON-DRYLAND | HRW | 67 |
| KS | GREELEY-CO | 67879 | CENTURY-DRYLAND | HRW | 73 |
| KS | GREELEY-CO | 67879 | CHISHOLM-DRYLAND | HRW | 46 |
| | GREELEY-CO | 67879 | CODY-DRYLAND | HRW | 72 |
| | GREELEY-CO | 67879 | CODY-IRRIGATED | HRW | 65 |
| | GREELEY-CO | 67879 | COLT-DRYLAND | HRW | 64 |
| | GREELEY-CO | 67879 | COLT-IRRIGATED | HRW | 62 |
| | GREELEY-CO | 67879 | DODGE-DRYLAND | HRW | 65 |
| | GREELEY-CO | 67879 | DODGE-DRYLAND | HRW | 70 |
| | GREELEY-CO | 67879 | KARL-DRYLAND | HRW | 69 |
| | GREELEY-CO | 67879 | KARL-IRRIGATED | HRW | 67 |
| | GREELEY-CO | 67879 | LARNED-DRYLAND | HRW | 67 |
| | GREELEY-CO | 67879 | MESA-DRYLAND | HRW | 71 |
| | GREELEY-CO | 67879 | MESA-IRRIGATED | HRW | 63 |
| | GREELEY-CO | 67879 | MUSTANG-DRYLAND | HRW | 71 |
| | GREELEY-CO | 67879 | MUSTANG-IRRIGATED | HRW | 61 |
| | GREELEY-CO | 67879 | NEWTON-DRYLAND | HRW | 63 |
| | GREELEY-CO | 67879 | NEWTON-IRRIGATED | HRW | 52 |
| | GREELEY-CO | 67879 | NORKAN-DRYLAND | HRW | 66 |
| | GREELEY-CO | 67879 | NORKAN-IRRIGATED | HRW | 65 |
| | GREELEY-CO | 67879 | PIONEER-2154-DRYLAND | HRW | 57 |

TABLE 2. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|------------|---------|------------------------|-------|----------|
| KS | GREELEY-CO | 67879 | PIONEER-2154-DRYLAND | HRW | 74 |
| KS | GREELEY-CO | 67879 | PIONEER-2157-DRYLAND | HRW | 57 |
| KS | GREELEY-CO | 67879 | PIONEER-2157-IRRIGATED | HRW | 53 |
| KS | GREELEY-CO | 67879 | PIONEER-2172-DRYLAND | HRW | 76 |
| KS | GREELEY-CO | 67879 | PIONEER-2172-IRRIGATED | HRW | 71 |
| KS | GREELEY-CO | 67879 | QUANTUM-578-DRYLAND | HRW | 77 |
| KS | GREELEY-CO | 67879 | QUANTUM-578-IRRIGATED | HRW | 55 |
| KS | GREELEY-CO | 67879 | REDLAND-DRYLAND | HRW | 63 |
| KS | GREELEY-CO | 67879 | RIO-BLANCO-IRRIGATED | HWW | 59 |
| KS | GREELEY-CO | 67879 | SANDY-DRYLAND | HRW | 74 |
| KS | GREELEY-CO | 67879 | SCOUT-66-DRYLAND | HRW | 71 |
| KS | GREELEY-CO | 67879 | SIOUXLAND-DRYLAND | HRW | 71 |
| KS | GREELEY-CO | 67879 | SIOUXLAND-IRRIGATED | HRW | 60 |
| KS | GREELEY-CO | 67879 | STALLION-IRRIGATED | HRW | 63 |
| KS | GREELEY-CO | 67879 | TAM-105-DRYLAND | HRW | 56 |
| KS | GREELEY-CO | 67879 | TAM-105-DRYLAND | HRW | 79 |
| KS | GREELEY-CO | 67879 | TAM-107-DRYLAND | HRW | 65 |
| KS | GREELEY-CO | 67879 | TAM-107-DRYLAND | HRW | 71 |
| KS | GREELEY-CO | 67879 | TAM-108-DRYLAND | HRW | 50 |
| KS | GREELEY-CO | 67879 | TAM-108-DRYLAND | HRW | 66 |
| KS | GREELEY-CO | 67879 | TAM-200-DRYLAND | HRW | 68 |
| KS | GREELEY-CO | 67879 | TAM-200-IRRIGATED | HRW | 59 |
| KS | GREELEY-CO | 67879 | THUNDERBIRD-DRYLAND | HRW | 78 |
| KS | GREELEY-CO | 67879 | THUNDERBIRD-IRRIGATED | HRW | 72 |
| KS | GREELEY-CO | 67879 | VICTORY-IRRIGATED | HRW | 63 |
| KS | HARVEY-CO | 67114 | ABILENE-DRYLAND | HRW | 53 |
| KS | HARVEY-CO | 67114 | ARKAN-DRYLAND | HRW | 57 |
| KS | HARVEY-CO | 67114 | BH-122-DRYLAND | HRW | 47 |
| KS | HARVEY-CO | 67114 | BH-203A-DRYLAND | HRW | 46 |
| KS | HARVEY-CO | 67114 | CENTURY-DRYLAND | HRW | 50 |
| KS | HARVEY-CO | 67114 | CHISHOLM-DRYLAND | HRW | 38 |
| KS | HARVEY-CO | 67114 | DELANGE-7837-DRYLAND | HRW | 53 |
| KS | HARVEY-CO | 67114 | LARNED-DRYLAND | HRW | 57 |
| KS | HARVEY-CO | 67114 | MESA-DRYLAND | HRW | 59 |
| KS | HARVEY-CO | 67114 | MUSTANG-DRYLAND | HRW | 53 |
| KS | HARVEY-CO | 67114 | NEWTON-DRYLAND | HRW | 53 |
| KS | HARVEY-CO | 67114 | NORKAN-DRYLAND | HRW | 59 |
| KS | HARVEY-CO | 67114 | PIONEER-2154-DRYLAND | HRW | 73 |
| KS | HARVEY-CO | 67114 | PIONEER-2157-DRYLAND | HRW | 50 |
| KS | HARVEY-CO | 67114 | PIONEER-2172-DRYLAND | HRW | 72 |
| KS | HARVEY-CO | 67114 | RIO-BLANCO-DRYLAND | HWW | 51 |
| KS | HARVEY-CO | 67114 | SCOUT-66-DRYLAND | HRW | 66 |
| KS | HARVEY-CO | 67114 | SIOUXLAND-DRYLAND | HRW | 61 |
| KS | HARVEY-CO | 67114 | STALLION-DRYLAND | HRW | 54 |
| KS | HARVEY-CO | 67114 | TAM-105-DRYLAND | HRW | 63 |
| KS | HARVEY-CO | 67114 | TAM-108-DRYLAND | HRW | 47 |
| KS | HARVEY-CO | 67114 | TAM-200-DRYLAND | HRW | 46 |
| KS | HARVEY-CO | 67114 | THUNDERBIRD-DRYLAND | HRW | 66 |
| KS | HARVEY-CO | 67114 | VICTORY-DRYLAND | HRW | 58 |
| KS | HAVEN | 67543 | ARKAN | HRW | 65 |
| KS | HAVILAND | 67059 | ARKAN | HRW | 63 |

TABLE 2. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|--------------|---------|-----------------------|-------|----------|
| KS | HILLSBORO | 67063 | ARKAN | HRW | 58 |
| KS | HOPE | 67451 | NORKAN | HRW | 66 |
| KS | HOPE | 67451 | RH7837 | HRW | 61 |
| KS | HOPE | 67451 | RH7846 | HRW | 57 |
| KS | HUGOTON | 67951 | THUNDERBIRD | HRW | 68 |
| KS | INMAN | 67546 | TRIUMPH-64 | HRW | 55 |
| KS | JEWELL | 66949 | NORKAN | HRW | 71 |
| KS | KINGMAN | 67068 | ABILENE | HRW | 73 |
| KS | LABETTE | 67350 | ABILENE-DRYLAND | HRW | 68 |
| KS | LABETTE | 67350 | ARKAN-DRYLAND | HRW | 66 |
| KS | LABETTE | 67350 | BECKER-DRYLAND | SRW | 26 |
| KS | LABETTE | 67350 | BH-122-DRYLAND | HRW | 55 |
| KS | LABETTE | 67350 | BH-203A-DRYLAND | HRW | 53 |
| KS | LABETTE | 67350 | CENTURY-DRYLAND | HRW | 67 |
| KS | LABETTE | 67350 | COMPTON-DRYLAND | SRW | 26 |
| KS | LABETTE | 67350 | DELANGE-7834-DRYLAND | HRW | 62 |
| KS | LABETTE | 67350 | DELANGE-7846-DRYLAND | HRW | 68 |
| KS | LABETTE | 67350 | KARL-DRYLAND | HRW | 68 |
| KS | LABETTE | 67350 | LARNED-DRYLAND | HRW | 73 |
| KS | LABETTE | 67350 | MESA-DRYLAND | HRW | 72 |
| KS | LABETTE | 67350 | MO-9965-EXP-DRYLAND | SRW | 14 |
| KS | LABETTE | 67350 | MUSTANG-DRYLAND | HRW | 66 |
| KS | LABETTE | 67350 | NEWTON-DRYLAND | HRW | 66 |
| KS | LABETTE | 67350 | NORKAN-DRYLAND | HRW | 68 |
| KS | LABETTE | 67350 | PIONEER-2154-DRYLAND | HRW | 84 |
| KS | LABETTE | 67350 | PIONEER-2157-DRYLAND | HRW | 66 |
| KS | LABETTE | 67350 | PIONEER-2172-DRYLAND | HRW | 84 |
| KS | LABETTE | 67350 | PIONEER-2551-DRYLAND | SRW | 22 |
| KS | LABETTE | 67350 | RIO-BLANCO-DRYLAND | HWW | 66 |
| KS | LABETTE | 67350 | SCOUT-66-DRYLAND | HRW | 74 |
| KS | LABETTE | 67350 | SIOUXLAND-DRYLAND | HRW | 70 |
| KS | LABETTE | 67350 | STAR-SEED-830-DRYLAND | HRW | 76 |
| KS | LABETTE | 67350 | TAM-105-DRYLAND | HRW | 74 |
| KS | LABETTE | 67350 | TAM-107-DRYLAND | HRW | 53 |
| KS | LABETTE | 67350 | TAM-108-DRYLAND | HRW | 79 |
| KS | LABETTE | 67350 | TERRA-SR86-DRYLAND | SRW | 30 |
| KS | LABETTE | 67350 | THUNDERBIRD-DRYLAND | HRW | 80 |
| KS | LABETTE | 67350 | TRIUMPH-64-DRYLAND | HRW | 68 |
| KS | LABETTE | 67350 | VICTORY-DRYLAND | HRW | 68 |
| KS | LABETTE | 67350 | W85-120-EXP-DRYLAND | HRW | 80 |
| KS | LANGDON | 67549 | NEWTON | HRW | 61 |
| KS | LARNED | 67550 | DODGE | HRW | 72 |
| KS | LARNED | 67550 | LARNED | HRW | 76 |
| KS | LARNED | 67550 | TAM-107 | HRW | 79 |
| KS | LITTLE-RIVER | 67457 | THUNDERBIRD | HRW | 70 |
| KS | LYONS | 67554 | SIOUXLAND | HRW | 68 |
| KS | MANHATTAN | 66502 | ARKAN | HRW | 65 |
| KS | MANHATTAN | 66502 | MESA | HRW | 73 |
| KS | MANHATTAN | 66502 | NEWTON | HRW | 53 |
| KS | MANHATTAN | 66502 | NORKAN | HRW | 54 |
| KS | MANTER | 67862 | DODGE | HRW | 73 |

TABLE 2. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|------------|---------|-----------------------|-------|----------|
| KS | MANTER | 67862 | EAGLE | HRW | 76 |
| KS | MANTER | 67862 | NEWTON | HRW | 70 |
| KS | MANTER | 67862 | TAM-107 | HRW | 83 |
| KS | MENLO | 67746 | LARNED | HRW | 71 |
| KS | MENTOR | 67401 | ABILENE | HRW | 64 |
| KS | MILFORD | 66514 | ARKAN | HRW | 61 |
| KS | MILTONVALE | 67466 | ARKAN | HRW | 66 |
| KS | MILTONVALE | 67466 | NORKAN | HRW | 73 |
| KS | MORAN | 66755 | ABILENE | HRW | 69 |
| KS | MORAN | 66755 | ARKAN | HRW | 45 |
| KS | MORAN | 66755 | CALDWELL | SRW | 19 |
| KS | MORAN | 66755 | MESA | HRW | 59 |
| KS | MORAN | 66755 | TAM-107 | HRW | 63 |
| KS | OSBORN | 67473 | NEWTON | HRW | 61 |
| KS | OSBORN | 67473 | VICTORY | HRW | 72 |
| KS | PALMER | 66962 | ABILENE | HRW | 69 |
| KS | PALMER | 66962 | ARKAN | HRW | 58 |
| KS | PALMER | 66962 | ARKAN | HRW | 70 |
| KS | PALMER | 66962 | MESA | HRW | 76 |
| KS | PALMER | 66962 | RH7846 | HRW | 61 |
| KS | PALMER | 66962 | THUNDERBIRD | HRW | 68 |
| KS | PALMER | 66962 | VICTORY | HRW | 69 |
| KS | PARTRIDGE | 67566 | ABILENE | HRW | 66 |
| KS | PARTRIDGE | 67566 | MESA | HRW | 72 |
| KS | PENOKEE | 67642 | LARNED | HRW | 63 |
| KS | PENOKEE | 67642 | LARNED | HRW | 66 |
| KS | RANSOM | 67572 | DODGE | HRW | 67 |
| KS | RANSOM | 67572 | LARNED | HRW | 67 |
| KS | RENO-CO | 67501 | ABILENE-DRYLAND | HRW | 47 |
| KS | RENO-CO | 67501 | ARKAN-DRYLAND | HRW | 45 |
| KS | RENO-CO | 67501 | BH-122-DRYLAND | HRW | 37 |
| KS | RENO-CO | 67501 | BH-203A-DRYLAND | HRW | 36 |
| KS | RENO-CO | 67501 | BH-206-DRYLAND | HRW | 47 |
| KS | RENO-CO | 67501 | CENTURA-DRYLAND | HRW | 50 |
| KS | RENO-CO | 67501 | CENTURY-DRYLAND | HRW | 50 |
| KS | RENO-CO | 67501 | CHISHOLM-DRYLAND | HRW | 27 |
| KS | RENO-CO | 67501 | DELANGE-7837-DRYLAND | HRW | 46 |
| KS | RENO-CO | 67501 | DELANGE-7846-DRYLAND | HRW | 39 |
| KS | RENO-CO | 67501 | KARL-DRYLAND | HRW | 45 |
| KS | RENO-CO | 67501 | KS84HW196-EXP-DRYLAND | HRW | 44 |
| KS | RENO-CO | 67501 | LARNED-DRYLAND | HRW | 45 |
| KS | RENO-CO | 67501 | MESA-DRYLAND | HRW | 53 |
| KS | RENO-CO | 67501 | MUSTANG-DRYLAND | | |
| KS | RENO-CO | 67501 | NEWTON-DRYLAND | | |
| KS | RENO-CO | 67501 | NORKAN-DRYLAND | | |
| KS | RENO-CO | 67501 | PIONEER-2157-DRYLAND | | |
| KS | RENO-CO | 67501 | PIONEER-2172-DRYLAND | | |
| KS | RENO-CO | 67501 | RIO-BLANCO-DRYLAND | | |
| KS | RENO-CO | 67501 | SIOUXLAND-DRYLAND | HRW | 39 |
| KS | RENO-CO | 67501 | STALLION-DRYLAND | HRW | 40 |
| KS | RENO-CO | 67501 | STALLION-DRYLAND | HRW | 48 |

TABLE 2. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|-------------|---------|-----------------------|-------|----------|
| KS | RENO-CO | 67501 | TAM-105-DRYLAND | HRW | 44 |
| KS | RENO-CO | 67501 | TAM-107-DRYLAND | HRW | 54 |
| KS | RENO-CO | 67501 | TAM-108-DRYLAND | HRW | 33 |
| KS | RENO-CO | 67501 | TAM-108-DRYLAND | HRW | 40 |
| KS | RENO-CO | 67501 | TAM-200-DRYLAND | HRW | 43 |
| KS | RENO-CO | 67501 | THUNDERBIRD-DRYLAND | HRW | 51 |
| KS | RENO-CO | 67501 | TRIUMPH-64-DRYLAND | HRW | 47 |
| KS | REPUBLIC-CO | 66935 | ABILENE-DRYLAND | HRW | 66 |
| KS | REPUBLIC-CO | 66935 | ARKAN-DRYLAND | HRW | 58 |
| KS | REPUBLIC-CO | 66935 | BH-122-DRYLAND | HRW | 61 |
| KS | REPUBLIC-CO | 66935 | BH-203A-DRYLAND | HRW | 48 |
| KS | REPUBLIC-CO | 66935 | CENTURA-DRYLAND | HRW | 69 |
| KS | REPUBLIC-CO | 66935 | CHISHOLM-DRYLAND | HRW | 38 |
| KS | REPUBLIC-CO | 66935 | CODY-DRYLAND | HRW | 71 |
| KS | REPUBLIC-CO | 66935 | COLT-DRYLAND | HRW | 56 |
| KS | REPUBLIC-CO | 66935 | DODGE-DRYLAND | HRW | 68 |
| KS | REPUBLIC-CO | 66935 | KARL-DRYLAND | HRW | 62 |
| KS | REPUBLIC-CO | 66935 | MESA-DRYLAND | HRW | 64 |
| KS | REPUBLIC-CO | 66935 | MUSTANG-DRYLAND | HRW | 59 |
| KS | REPUBLIC-CO | 66935 | NEWTON-DRYLAND | HRW | 57 |
| KS | REPUBLIC-CO | 66935 | NORKAN-DRYLAND | HRW | 60 |
| KS | REPUBLIC-CO | 66935 | PIONEER-2154-DRYLAND | HRW | 75 |
| KS | REPUBLIC-CO | 66935 | PIONEER-2157-DRYLAND | HRW | 60 |
| KS | REPUBLIC-CO | 66935 | PIONEER-2172-DRYLAND | HRW | 73 |
| KS | REPUBLIC-CO | 66935 | QUANTUM-562-DRYLAND | HRW | 61 |
| KS | REPUBLIC-CO | 66935 | REDLAND-DRYLAND | HRW | 65 |
| KS | REPUBLIC-CO | 66935 | SCOUT-66-DRYLAND | HRW | 64 |
| KS | REPUBLIC-CO | 66935 | STAR-SEED-830-DRYLAND | HRW | 64 |
| KS | REPUBLIC-CO | 66935 | TAM-105-DRYLAND | HRW | 64 |
| KS | REPUBLIC-CO | 66935 | TAM-107-DRYLAND | HRW | 73 |
| KS | REPUBLIC-CO | 66935 | TAM-108-DRYLAND | HRW | 55 |
| KS | REPUBLIC-CO | 66935 | TAM-200-DRYLAND | HRW | 59 |
| KS | REPUBLIC-CO | 66935 | THUNDERBIRD-DRYLAND | HRW | 68 |
| KS | REPUBLIC-CO | 66935 | TRAILBLAZER-DRYLAND | HRW | 65 |
| KS | REPUBLIC-CO | 66935 | VICTORY-DRYLAND | HRW | 63 |
| KS | RILEY-CO | 66502 | ARKAN-DRYLAND | HRW | 58 |
| KS | RILEY-CO | 66502 | CALDWELL-DRYLAND | SRW | 19 |
| KS | RILEY-CO | 66502 | CENTURA-DRYLAND | HRW | 73 |
| KS | RILEY-CO | 66502 | CENTURY-DRYLAND | HRW | 60 |
| KS | RILEY-CO | 66502 | CHISHOLM-DRYLAND | HRW | 38 |
| KS | RILEY-CO | 66502 | COLT-DRYLAND | HRW | 50 |
| KS | RILEY-CO | 66502 | COMPTON-DRYLAND | SRW | 15 |
| KS | RILEY-CO | 66502 | DELANGE-7846-DRYLAND | HRW | 57 |
| KS | RILEY-CO | 66502 | KARL-DRYLAND | HRW | 55 |
| KS | RILEY-CO | 66502 | LARNED-DRYLAND | HRW | 64 |
| KS | RILEY-CO | 66502 | MESA-DRYLAND | HRW | 62 |
| KS | RILEY-CO | 66502 | MO-9965-EXP-DRYLAND | SRW | 8 |
| KS | RILEY-CO | 66502 | MUSTANG-DRYLAND | HRW | 60 |
| KS | RILEY-CO | 66502 | NEWTON-DRYLAND | HRW | 56 |
| KS | RILEY-CO | 66502 | NORKAN-DRYLAND | HRW | 59 |
| KS | RILEY-CO | 66502 | PIONEER-2154-DRYLAND | HRW | 80 |

TABLE 2. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|-------------|---------|------------------------|-------|----------|
| KS | RILEY-CO | 66502 | PIONEER-2157-DRYLAND | HRW | 50 |
| KS | RILEY-CO | 66502 | PIONEER-2172-DRYLAND | HRW | 60 |
| KS | RILEY-CO | 66502 | PIONEER-2551-DRYLAND | SRW | 19 |
| KS | RILEY-CO | 66502 | RIO-BLANCO-DRYLAND | HWW | 56 |
| KS | RILEY-CO | 66502 | SCOUT-66-DRYLAND | HRW | 64 |
| KS | RILEY-CO | 66502 | SIOUXLAND-DRYLAND | HRW | 62 |
| KS | RILEY-CO | 66502 | STAR-SEED-830-DRYLAND | HRW | 67 |
| KS | RILEY-CO | 66502 | TAM-105-DRYLAND | HRW | 65 |
| KS | RILEY-CO | 66502 | TAM-107-DRYLAND | HRW | 72 |
| KS | RILEY-CO | 66502 | TAM-108-DRYLAND | HRW | 51 |
| KS | RILEY-CO | 66502 | TAM-200-DRYLAND | HRW | 55 |
| KS | RILEY-CO | 66502 | THUNDERBIRD-DRYLAND | HRW | 68 |
| KS | RILEY-CO | 66502 | VICTORY-DRYLAND | HRW | 60 |
| KS | RILEY-CO | 66502 | W85-162-EXP-DRYLAND | HRW | 59 |
| KS | SABETHA | 66534 | ARKAN | HRW | 55 |
| KS | SABETHA | 66534 | NORKAN | HRW | 63 |
| KS | SATANTA | 67870 | TAM-107 | HRW | 79 |
| KS | STAFFORD-CO | 67576 | ABILENE-DRYLAND | HRW | 61 |
| KS | STAFFORD-CO | 67576 | ABILENE-IRRIGATED | HRW | 60 |
| KS | STAFFORD-CO | 67576 | ARKAN-DRYLAND | HRW | 52 |
| KS | STAFFORD-CO | 67576 | ARKAN-IRRIGATED | HRW | 55 |
| KS | STAFFORD-CO | 67576 | BH-122-DRYLAND | HRW | 51 |
| KS | STAFFORD-CO | 67576 | BH-122-IRRIGATED | HRW | 47 |
| KS | STAFFORD-CO | 67576 | BH-203A-DRYLAND | HRW | 42 |
| KS | STAFFORD-CO | 67576 | BH-203A-IRRIGATED | HRW | 42 |
| KS | STAFFORD-CO | 67576 | BH-206-IRRIGATED | HRW | 62 |
| KS | STAFFORD-CO | 67576 | BRONCO-DRYLAND | HRW | 55 |
| KS | STAFFORD-CO | 67576 | CALDWELL-IRRIGATED | SRW | 25 |
| KS | STAFFORD-CO | 67576 | CARSON-DRYLAND | HRW | 60 |
| KS | STAFFORD-CO | 67576 | CENTURA-DRYLAND | HRW | 65 |
| KS | STAFFORD-CO | 67576 | CENTURY-DRYLAND | HRW | 60 |
| KS | STAFFORD-CO | 67576 | CENTURY-IRRIGATED | HRW | 55 |
| KS | STAFFORD-CO | 67576 | CHISHOLM-DRYLAND | HRW | 37 |
| KS | STAFFORD-CO | 67576 | CHISHOLM-IRRIGATED | HRW | 37 |
| KS | STAFFORD-CO | 67576 | CO820026-EXP-IRRIGATED | HRW | 54 |
| KS | STAFFORD-CO | 67576 | COMPTON-IRRIGATED | SRW | 18 |
| KS | STAFFORD-CO | 67576 | DELANGE-7837-DRYLAND | HRW | 50 |
| KS | STAFFORD-CO | 67576 | DELANGE-7846-DRYLAND | HRW | 54 |
| KS | STAFFORD-CO | 67576 | DODGE-DRYLAND | HRW | 59 |
| KS | STAFFORD-CO | 67576 | DODGE-IRRIGATED | HRW | 56 |
| KS | STAFFORD-CO | 67576 | KARL-DRYLAND | HRW | 62 |
| KS | STAFFORD-CO | 67576 | KARL-IRRIGATED | HRW | 55 |
| KS | STAFFORD-CO | 67576 | KS84HW196-EXP-DRYLAND | HWW | 56 |
| KS | STAFFORD-CO | 67576 | LARNED-DRYLAND | HRW | 63 |
| KS | STAFFORD-CO | 67576 | MESA-DRYLAND | HRW | 68 |
| KS | STAFFORD-CO | 67576 | MESA-IRRIGATED | HRW | 64 |
| KS | STAFFORD-CO | 67576 | NEWTON-DRYLAND | HRW | 58 |
| KS | STAFFORD-CO | 67576 | NEWTON-IRRIGATED | HRW | 49 |
| KS | STAFFORD-CO | 67576 | NORKAN-IRRIGATED | HRW | 59 |
| KS | STAFFORD-CO | 67576 | PIONEER-2154-DRYLAND | HRW | 75 |
| KS | STAFFORD-CO | 67576 | PIONEER-2154-IRRIGATED | HRW | 77 |

TABLE 2. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|--------------|---------|-------------------------|-------|----------|
| KS | STAFFORD-CO | 67576 | PIONEER-2157-DRYLAND | HRW | 52 |
| KS | STAFFORD-CO | 67576 | PIONEER-2157-IRRIGATED | HRW | 53 |
| KS | STAFFORD-CO | 67576 | PIONEER-2172-DRYLAND | HRW | 68 |
| KS | STAFFORD-CO | 67576 | RIO-BLANCO-DRYLAND | HWW | 61 |
| KS | STAFFORD-CO | 67576 | RIO-BLANCO-IRRIGATED | HWW | 58 |
| KS | STAFFORD-CO | 67576 | SANDY-DRYLAND | HRW | 68 |
| KS | STAFFORD-CO | 67576 | SCOUT-66-DRYLAND | HRW | 63 |
| KS | STAFFORD-CO | 67576 | SIOUXLAND-DRYLAND | HRW | 59 |
| KS | STAFFORD-CO | 67576 | SIOUXLAND-IRRIGATED | HRW | 61 |
| KS | STAFFORD-CO | 67576 | STALLION-DRYLAND | HRW | 60 |
| KS | STAFFORD-CO | 67576 | STALLION-IRRIGATED | HRW | 60 |
| KS | STAFFORD-CO | 67576 | TAM-105-DRYLAND | HRW | 62 |
| KS | STAFFORD-CO | 67576 | TAM-105-IRRIGATED | HRW | 57 |
| KS | STAFFORD-CO | 67576 | TAM-107-DRYLAND | HRW | 68 |
| KS | STAFFORD-CO | 67576 | TAM-108-DRYLAND | HRW | 44 |
| KS | STAFFORD-CO | 67576 | TAM-108-IRRIGATED | HRW | 50 |
| KS | STAFFORD-CO | 67576 | TAM-200-DRYLAND | HRW | 53 |
| KS | STAFFORD-CO | 67576 | THUNDERBIRD-IRRIGATED | HRW | 67 |
| KS | STAFFORD-CO | 67576 | VICTORY-DRYLAND | HRW | 63 |
| KS | STAFFORD-CO | 67576 | VICTORY-IRRIGATED | HRW | 61 |
| KS | STAFFORD-CO | 67576 | VONA-DRYLAND | HRW | 51 |
| KS | SUBLETTE | 67877 | SCOUT-66 | HRW | 76 |
| KS | SUBLETTE | 67877 | TAM-107 | HRW | 74 |
| KS | SYLVAN-GROVE | 67481 | ARKAN | HRW | 65 |
| KS | SYLVAN-GROVE | 67481 | ARKAN | HRW | 65 |
| KS | THOMAS-CO | 66701 | ABILENE-DRYLAND | HRW | 63 |
| KS | THOMAS-CO | 66701 | ARKAN-DRYLAND | HRW | 59 |
| KS | THOMAS-CO | 66701 | ARKAN-IRRIGATED | HRW | 60 |
| KS | THOMAS-CO | 66701 | BH-122-IRRIGATED | HRW | 58 |
| KS | THOMAS-CO | 66701 | BH-203A-IRRIGATED | HRW | 46 |
| KS | THOMAS-CO | 66701 | CARSON-DRYLAND | HRW | 67 |
| KS | THOMAS-CO | 66701 | CENTURA-DRYLAND | HRW | 75 |
| KS | THOMAS-CO | 66701 | CENTURY-IRRIGATED | HRW | 61 |
| KS | THOMAS-CO | 66701 | CHISHOLM-IRRIGATED | HRW | 54 |
| KS | THOMAS-CO | 66701 | CO820026-EXP-DRYLAND | HRW | 60 |
| KS | THOMAS-CO | 66701 | CO820026-EXP-IRRIGATED | HRW | 62 |
| KS | THOMAS-CO | 66701 | CODY-DRYLAND | HRW | 71 |
| KS | THOMAS-CO | 66701 | CODY-IRRIGATED | HRW | 67 |
| KS | THOMAS-CO | 66701 | COLT-DRYLAND | HRW | 60 |
| KS | THOMAS-CO | 66701 | DELANGE-7837-DRYLAND | HRW | 59 |
| KS | THOMAS-CO | 66701 | DELANGE-7846-DRYLAND | HRW | 60 |
| KS | THOMAS-CO | 66701 | DODGE-DRYLAND | HRW | 62 |
| KS | THOMAS-CO | 66701 | KARL-DRYLAND | HRW | 70 |
| KS | THOMAS-CO | 66701 | KARL-IRRIGATED | HRW | 63 |
| KS | THOMAS-CO | 66701 | KS84W196-EXP-DRYLAND | HWW | 70 |
| KS | THOMAS-CO | 66701 | KS84WH196-EXP-IRRIGATED | HWW | 67 |
| KS | THOMAS-CO | 66701 | LARNED-DRYLAND | HRW | 65 |
| KS | THOMAS-CO | 66701 | MESA-DRYLAND | HRW | 60 |
| KS | THOMAS-CO | 66701 | MESA-IRRIGATED | HRW | 60 |
| KS | THOMAS-CO | 66701 | MUSTANG-DRYLAND | HRW | 63 |
| KS | THOMAS-CO | 66701 | NEWTON-DRYLAND | HRW | 58 |

TABLE 2. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|-----------|---------|------------------------|-------|----------|
| KS | THOMAS-CO | 66701 | NORKAN-DRYLAND | HRW | 65 |
| KS | THOMAS-CO | 66701 | PIONEER-2154-IRRIGATED | HRW | 76 |
| KS | THOMAS-CO | 66701 | PIONEER-2172-DRYLAND | HRW | 71 |
| KS | THOMAS-CO | 66701 | PIONEER-2172-IRRIGATED | HRW | 76 |
| KS | THOMAS-CO | 66701 | QUANTUM-562-DRYLAND | HRW | 59 |
| KS | THOMAS-CO | 66701 | QUANTUM-578-IRRIGATED | HRW | 63 |
| KS | THOMAS-CO | 66701 | REDLAND-DRYLAND | HRW | 57 |
| KS | THOMAS-CO | 66701 | RIO-BLANCO-DRYLAND | HWW | 61 |
| KS | THOMAS-CO | 66701 | RIO-BLANCO-IRRIGATED | HWW | 58 |
| KS | THOMAS-CO | 66701 | SCOUT-66-DRYLAND | HRW | 68 |
| KS | THOMAS-CO | 66701 | SIOUXLAND-IRRIGATED | HRW | 65 |
| KS | THOMAS-CO | 66701 | TAM-105-DRYLAND | HRW | 53 |
| KS | THOMAS-CO | 66701 | TAM-105-IRRIGATED | HRW | 69 |
| KS | THOMAS-CO | 66701 | TAM-107-DRYLAND | HRW | 72 |
| KS | THOMAS-CO | 66701 | TAM-107-IRRIGATED | HRW | 72 |
| KS | THOMAS-CO | 66701 | TAM-108 | HRW | 64 |
| KS | THOMAS-CO | 66701 | TAM-108-IRRIGATED | HRW | 55 |
| KS | THOMAS-CO | 66701 | TAM-200-DRYLAND | HRW | 57 |
| KS | THOMAS-CO | 66701 | TAM-200-IRRIGATED | HRW | 59 |
| KS | THOMAS-CO | 66701 | THUNDERBIRD-DRYLAND | HRW | 70 |
| KS | THOMAS-CO | 66701 | THUNDERBIRD-IRRIGATED | HRW | 70 |
| KS | THOMAS-CO | 66701 | VICTORY-DRYLAND | HRW | 67 |
| KS | THOMAS-CO | 66701 | VICTORY-IRRIGATED | HRW | 66 |
| KS | TIMKEN | 67582 | DODGE | HRW | 69 |
| KS | TIMKEN | 67582 | NEWTON | HRW | 59 |
| KS | TIMKEN | 67582 | TAM-107 | HRW | 81 |
| KS | ULYSSES | 67880 | MESA | HRW | 68 |
| KS | ULYSSES | 67880 | THUNDERBIRD | HRW | 85 |
| KS | WAKENEY | 67672 | LARNED | HRW | 71 |
| KS | WILSEY | 66873 | ABILENE | HRW | 62 |
| KS | WILSEY | 66873 | VICTORY | HRW | 59 |
| KS | WINFIELD | 67156 | MESA | HRW | 64 |
| KS | WINFIELD | 67156 | MESA | HRW | 66 |
| KS | WINFIELD | 67156 | VICTORY | HRW | 54 |
| KS | WINONA | 67764 | TAM-107 | HRW | 79 |
| MN | CROOKSTON | 56716 | LEN | HRS | 72 |
| MN | CROOKSTON | 56716 | MARSHALL | HRS | 66 |
| MN | CROOKSTON | 56716 | PIONEER-2360 | HRS | 78 |
| MN | CROOKSTON | 56716 | STOA | HRS | 73 |
| MN | CROOKSTON | 56716 | WHEATON | HRS | 70 |
| MN | MORRIS | 56267 | LEN | HRS | 81 |
| MN | MORRIS | 56267 | MARSHALL | HRS | 69 |
| MN | MORRIS | 56267 | PIONEER-2306 | HRS | 78 |
| MN | MORRIS | 56267 | STOA | HRS | 79 |
| MN | MORRIS | 56267 | WHEATON | HRS | 75 |
| MN | ST-PAUL | 55101 | LEN | HRS | 81 |
| MN | ST-PAUL | 55101 | MARSHALL | HRS | 76 |
| MN | ST-PAUL | 55101 | PIONEER-2360 | HRS | 84 |
| MN | ST-PAUL | 55101 | STOA | HRS | 87 |
| OK | ALTUS | 73521 | CENTURY-88 | HRW | 36 |
| OK | ALTUS | 73521 | CENTURY-88 | HRW | 57 |

TABLE 2. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY LOCATION

| STATE | REGION | ZIPCODE | VARIETY | CLASS |
|-------|----------|---------|---------------------------|-------|
| OK | ALTUS | 73521 | CHISHOLM-88 | HRW |
| OK | ALTUS | 73521 | CHISHOLM-88 | HRW |
| OK | ALTUS | 73521 | MUSTANG-88 | HRW |
| OK | ALTUS | 73521 | PIONEER-2157-88 | HRW |
| OK | ALTUS | 73521 | SIOUXLAND-88 | HRW |
| OK | ALTUS | 73521 | TAM-101-88 | HRW |
| OK | ALTUS | 73521 | TAM-101-88 | HRW |
| OK | ALTUS | 73521 | TRIUMPH-64-88 | HRW |
| OK | ALTUS | 73521 | TRIUMPH-64-88 | HRW |
| OK | GOODWELL | 73939 | CENTURY-87 | HRW |
| OK | GOODWELL | 73939 | CENTURY-87-IRRIGATED | HRW |
| OK | GOODWELL | 73939 | CENTURY-88 | HRW |
| OK | GOODWELL | 73939 | CENTURY-88-IRRIGATED | HRW |
| OK | GOODWELL | 73939 | CHISHOLM-87 | HRW |
| OK | GOODWELL | 73939 | CHISHOLM-88 | HRW |
| OK | GOODWELL | 73939 | CHISHOLM-88-IRRIGATED | HRW |
| OK | GOODWELL | 73939 | MUSTANG-87 | HRW |
| OK | GOODWELL | 73939 | MUSTANG-87-IRRIGATED | HRW |
| OK | GOODWELL | 73939 | PIONEER-2157-88 | HRW |
| OK | GOODWELL | 73939 | PIONEER-2157-88-IRRIGATED | HRW |
| OK | GOODWELL | 73939 | SIOUXLAND-87 | HRW |
| OK | GOODWELL | 73939 | SIOUXLAND-87-IRRIGATED | HRW |
| OK | GOODWELL | 73939 | SIOUXLAND-88 | HRW |
| OK | GOODWELL | 73939 | SIOUXLAND-88-IRRIGATED | HRW |
| OK | GOODWELL | 73939 | TAM-101-87 | HRW |
| OK | GOODWELL | 73939 | TAM-101-87-IRRIGATED | HRW |
| OK | GOODWELL | 73939 | TAM-101-88 | HRW |
| OK | GOODWELL | 73939 | TAM-101-88-IRRIGATED | HRW |
| OK | GOODWELL | 73939 | TRIUMPH-64-87-IRRIGATED | HRW |
| OK | GOODWELL | 73939 | TRIUMPH-64-88 | HRW |
| OK | GOODWELL | 73939 | TRIUMPH-64-88-IRRIGATED | HRW |
| OK | LAHOMA | 73754 | CENTURY-87 | HRW |
| OK | LAHOMA | 73754 | CENTURY-88 | HRW |
| OK | LAHOMA | 73754 | CHISHOLM-87 | HRW |
| OK | LAHOMA | 73754 | CHISHOLM-88 | HRW |
| OK | LAHOMA | 73754 | MUSTANG-87 | HRW |
| OK | LAHOMA | 73754 | PIONEER-2157-88 | HRW |
| OK | LAHOMA | 73754 | SIOUXLAND-87 | HRW |
| OK | LAHOMA | 73754 | TAM-101-87 | HRW |
| OK | LAHOMA | 73754 | TAM-101-88 | HRW |
| OK | LAHOMA | 73754 | TRIUMPH-64-88 | HRW |
| OK | NORDIN | 74631 | ABILENE | HRW |
| OK | NORDIN | 74631 | ARKAN | HRW |
| OK | NORDIN | 74631 | BH-122 | HRW |
| OK | NORDIN | 74631 | BH-301 | HRW |
| OK | NORDIN | 74631 | CARSON | HRW |
| OK | NORDIN | 74631 | CHISHOLM | HRW |
| OK | NORDIN | 74631 | KARL | HRW |
| OK | NORDIN | 74631 | MUSTANG | HRW |
| OK | NORDIN | 74631 | NORKAN | HRW |
| OK | NORDIN | 74631 | PIONEER-2154 | HRW |

TABLE 2. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|-----------|---------|-----------------|-------|----------|
| OK | NORDIN | 74631 | PIONEER-2157 | HRW | 61 |
| OK | NORDIN | 74631 | PIONEER-2163 | HRW | 62 |
| OK | NORDIN | 74631 | PIONEER-2172 | HRW | 74 |
| OK | NORDIN | 74631 | QUANTUM-378 | HRW | 57 |
| OK | NORDIN | 74631 | QUANTUM-564 | HRW | 54 |
| OK | NORDIN | 74631 | RH-7833 | HRW | 57 |
| OK | NORDIN | 74631 | RH-7837 | HRW | 55 |
| OK | NORDIN | 74631 | RIO-BLANCO | HWW | 58 |
| OK | NORDIN | 74631 | STALLION | HRW | 64 |
| OK | NORDIN | 74631 | TAM-105 | HRW | 68 |
| OK | NORDIN | 74631 | TAM-107 | HRW | 70 |
| OK | NORDIN | 74631 | TAM-108 | HRW | 48 |
| OK | NORDIN | 74631 | TAM-200 | HRW | 66 |
| OK | NORDIN | 74631 | TRAILBLAZER | HRW | 68 |
| OK | NORDIN | 74631 | WRANGLER | HRW | 67 |
| OK | STILLWELL | 74960 | CENTURY-87 | HRW | 41 |
| OK | STILLWELL | 74960 | CENTURY-88 | HRW | 66 |
| OK | STILLWELL | 74960 | CHISHOLM-87 | HRW | 28 |
| OK | STILLWELL | 74960 | CHISHOLM-88 | HRW | 42 |
| OK | STILLWELL | 74960 | PIONEER-2157-88 | HRW | 59 |
| OK | STILLWELL | 74960 | SIOUXLAND-87 | HRW | 50 |
| OK | STILLWELL | 74960 | SIOUXLAND-88 | HRW | 69 |
| OK | STILLWELL | 74960 | TAM-101-87 | HRW | 45 |
| OK | STILLWELL | 74960 | TAM-101-88 | HRW | 63 |
| OK | STILLWELL | 74960 | TRIUMPH-64-87 | HRW | 40 |
| OK | STILLWELL | 74960 | TRIUMPH-64-88 | HRW | 54 |
| OK | WOODWARD | 73801 | CENTURY-88 | HRW | 61 |
| OK | WOODWARD | 73801 | CHISHOLM-87 | HRW | 29 |
| OK | WOODWARD | 73801 | CHISHOLM-88 | HRW | 43 |
| OK | WOODWARD | 73801 | MUSTANG-87 | HRW | 46 |
| OK | WOODWARD | 73801 | PIONEER-2157-88 | HRW | 52 |
| OK | WOODWARD | 73801 | SIOUXLAND-87 | HRW | 50 |
| OK | WOODWARD | 73801 | SIOUXLAND-88 | HRW | 61 |
| OK | WOODWARD | 73801 | TAM-101 | HRW | 52 |
| OK | WOODWARD | 73801 | TAM-101-87 | HRW | 45 |
| OK | WOODWARD | 73801 | TRIUMPH-64-87 | HRW | 41 |
| OK | WOODWARD | 73801 | TRIUMPH-64-88 | HRW | 53 |
| OR | CORVALLIS | 97330 | CENTURY | HRW | 52 |
| OR | CORVALLIS | 97330 | CHEYENNE | HRW | 64 |
| OR | CORVALLIS | 97330 | COLT | HRW | 43 |
| OR | CORVALLIS | 97330 | DODGE | HRW | 48 |
| OR | CORVALLIS | 97330 | DUSTY | SWW | 21 |
| OR | CORVALLIS | 97330 | HILL-81 | SWW | 24 |
| OR | CORVALLIS | 97330 | KS-4578 | HRW | 68 |
| OR | CORVALLIS | 97330 | KS-831862 | HWW | 65 |
| OR | CORVALLIS | 97330 | MALCOLM | SWW | 27 |
| OR | CORVALLIS | 97330 | NORKAN | HRW | 60 |
| OR | CORVALLIS | 97330 | OR-CR8313 | HRW | 62 |
| OR | CORVALLIS | 97330 | OR8400464P | SWW | 20 |
| OR | CORVALLIS | 97330 | OR8400882H | SWW | 27 |
| OR | CORVALLIS | 97330 | OR8500305P | SWW | 20 |

TABLE 2. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|-----------|---------|--------------|-------|----------|
| OR | CORVALLIS | 97330 | OR8500378H | HWW | 54 |
| OR | CORVALLIS | 97330 | OR8500974P | SWW | 33 |
| OR | CORVALLIS | 97330 | OR8502288H | SWW | 18 |
| OR | CORVALLIS | 97330 | OR8505311P | SWW | 23 |
| OR | CORVALLIS | 97330 | OR8600049 | HWW | 64 |
| OR | CORVALLIS | 97330 | OR8600341 | HWW | 65 |
| OR | CORVALLIS | 97330 | OR8600471 | HWW | 54 |
| OR | CORVALLIS | 97330 | OR8600701 | HWW | 66 |
| OR | CORVALLIS | 97330 | OR860292 | SWW | 21 |
| OR | CORVALLIS | 97330 | OR860293 | SWW | 23 |
| OR | CORVALLIS | 97330 | OR860296 | SWW | 32 |
| OR | CORVALLIS | 97330 | OR860297 | HWW | 31 |
| OR | CORVALLIS | 97330 | OR860301 | SWW | 23 |
| OR | CORVALLIS | 97330 | OR860302 | SWW | 24 |
| OR | CORVALLIS | 97330 | OR860303 | SWW | 20 |
| OR | CORVALLIS | 97330 | OR860553 | SWW | 31 |
| OR | CORVALLIS | 97330 | OR860571 | SWW | 20 |
| OR | CORVALLIS | 97330 | OR860575 | SWW | 17 |
| OR | CORVALLIS | 97330 | OR860576 | SWW | 30 |
| OR | CORVALLIS | 97330 | OR860576 | SWW | 32 |
| OR | CORVALLIS | 97330 | OR860754 | SWW | 34 |
| OR | CORVALLIS | 97330 | OR860756 | HWW | 50 |
| OR | CORVALLIS | 97330 | OR861226 | SWW | 30 |
| OR | CORVALLIS | 97330 | OR861425 | SWW | 28 |
| OR | CORVALLIS | 97330 | OVESON | SWW | 20 |
| OR | CORVALLIS | 97330 | PIONEER-2551 | SRW | 24 |
| OR | HERMISTON | 97838 | HILL-81 | SWW | 22 |
| OR | HERMISTON | 97838 | OVESON | SWW | 31 |
| OR | HERMISTON | 97838 | STEPHENS | SWW | 24 |
| OR | HERMISTON | 97838 | TRES | CLUB | 30 |
| OR | MADRAS | 97741 | STEPHENS | SWW | 23 |
| OR | MADRAS | 97741 | STEPHENS | SWW | 24 |
| OR | MADRAS | 97741 | STEPHENS | SWW | 24 |
| OR | MADRAS | 97741 | STEPHENS | SWW | 26 |
| OR | MADRAS | 97741 | STEPHENS | SWW | 26 |
| OR | MADRAS | 97741 | STEPHENS | SWW | 27 |
| OR | MADRAS | 97741 | STEPHENS | SWW | 27 |
| OR | MADRAS | 97741 | STEPHENS | SWW | 27 |
| OR | MADRAS | 97741 | STEPHENS | SWW | 28 |
| OR | MORO | 97039 | CENTURY | HRW | 58 |
| OR | MORO | 97039 | CHEYENNE | HRW | 62 |
| OR | MORO | 97039 | COLT | HRW | 52 |
| OR | MORO | 97039 | DODGE | HRW | 57 |
| OR | MORO | 97039 | DUSTY | SWW | 11 |
| OR | MORO | 97039 | HILL-81 | SWW | 27 |
| OR | MORO | 97039 | KS-831862 | HWW | 70 |
| OR | MORO | 97039 | MALCOLM | SWW | 31 |
| OR | MORO | 97039 | NORKAN | HRW | 67 |
| OR | MORO | 97039 | OR-CR8313 | HRW | 61 |
| OR | MORO | 97039 | OR8400464P | SWW | 28 |
| OR | MORO | 97039 | OR8400882H | SWW | 27 |

TABLE 2. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|-----------|---------|--------------|-------|----------|
| OR | MORO | 97039 | OR8500374H | HWW | 64 |
| OR | MORO | 97039 | OR8500378H | HWW | 62 |
| OR | MORO | 97039 | OR8500974P | SWW | 27 |
| OR | MORO | 97039 | OR8502288H | SWW | 25 |
| OR | MORO | 97039 | OR8505311P | SWW | 42 |
| OR | MORO | 97039 | OR8600049 | HWW | 66 |
| OR | MORO | 97039 | OR8600341 | HWW | 63 |
| OR | MORO | 97039 | OR8600471 | HWW | 48 |
| OR | MORO | 97039 | OR8600701 | HWW | 73 |
| OR | MORO | 97039 | OR860293 | SWW | 25 |
| OR | MORO | 97039 | OR860296 | SWW | 32 |
| OR | MORO | 97039 | OR860297 | HWW | 25 |
| OR | MORO | 97039 | OR860301 | SWW | 22 |
| OR | MORO | 97039 | OR860302 | SWW | 28 |
| OR | MORO | 97039 | OR860303 | SWW | 27 |
| OR | MORO | 97039 | OR860436 | SWW | 20 |
| OR | MORO | 97039 | OR860553 | SWW | 29 |
| OR | MORO | 97039 | OR860571 | SWW | 28 |
| OR | MORO | 97039 | OR860576 | SWW | 31 |
| OR | MORO | 97039 | OR860754 | SWW | 24 |
| OR | MORO | 97039 | OR860756 | HWW | 39 |
| OR | MORO | 97039 | OR861219 | SWW | 27 |
| OR | MORO | 97039 | OR861226 | SWW | 28 |
| OR | MORO | 97039 | OR861425 | SWW | 27 |
| OR | MORO | 97039 | OVESON | SWW | 20 |
| OR | MORO | 97039 | PIONEER-2551 | SRW | 22 |
| OR | MORO | 97039 | STEPHENS | SWW | 30 |
| OR | MORO | 97039 | TAM-108 | HRW | 43 |
| OR | MORO | 97039 | TRES | CLUB | 27 |
| OR | PENDLETON | 97801 | DUSTY | SWW | 19 |
| OR | PENDLETON | 97801 | HILL-81 | SWW | 28 |
| OR | PENDLETON | 97801 | OR-CR8313 | HRW | 68 |
| OR | PENDLETON | 97801 | OR8400882H | SWW | 24 |
| OR | PENDLETON | 97801 | OR8500305P | SWW | 28 |
| OR | PENDLETON | 97801 | OR8500374H | HWW | 59 |
| OR | PENDLETON | 97801 | OR8500378H | HWW | 63 |
| OR | PENDLETON | 97801 | OR8500974P | SWW | 27 |
| OR | PENDLETON | 97801 | OR8502288H | SWW | 25 |
| OR | PENDLETON | 97801 | OR8505311P | SWW | 48 |
| OR | PENDLETON | 97801 | OR8600049 | HWW | 72 |
| OR | PENDLETON | 97801 | OR8600341 | HWW | 68 |
| OR | PENDLETON | 97801 | OR8600701 | HWW | 68 |
| OR | PENDLETON | 97801 | OR860292 | SWW | 26 |
| OR | PENDLETON | 97801 | OR860293 | SWW | 22 |
| OR | PENDLETON | 97801 | OR860296 | SWW | 30 |
| OR | PENDLETON | 97801 | OR860301 | SWW | 22 |
| OR | PENDLETON | 97801 | OR860302 | SWW | 21 |
| OR | PENDLETON | 97801 | OR860303 | SWW | 21 |
| OR | PENDLETON | 97801 | OR860436 | SWW | 23 |
| OR | PENDLETON | 97801 | OR860553 | SWW | 25 |
| OR | PENDLETON | 97801 | OR860571 | SWW | 18 |

TABLE 2. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|-----------|---------|--------------|-------|----------|
| OR | PENDLETON | 97801 | OR860575 | SWW | 25 |
| OR | PENDLETON | 97801 | OR860754 | SWW | 32 |
| OR | PENDLETON | 97801 | OR860756 | HWW | 53 |
| OR | PENDLETON | 97801 | OR861219 | SWW | 30 |
| OR | PENDLETON | 97801 | OR861226 | SWW | 27 |
| OR | PENDLETON | 97801 | OR861425 | SWW | 30 |
| OR | PENDLETON | 97801 | OVESON | SWW | 32 |
| OR | PENDLETON | 97801 | STEPHENS | SWW | 27 |
| OR | PENDLETON | 97801 | TRES | CLUB | 31 |
| OR | WASCO-CO | 97063 | DUSTY | SWW | 16 |
| OR | WASCO-CO | 97063 | HILL-81 | SWW | 20 |
| OR | WASCO-CO | 97063 | MALCOLM | SWW | 20 |
| OR | WASCO-CO | 97063 | OR-CR8313 | HRW | 63 |
| OR | WASCO-CO | 97063 | OVESON | SWW | 22 |
| OR | WASCO-CO | 97063 | STEPHENS | SWW | 21 |
| OR | WASCO-CO | 97063 | TRES | CLUB | 25 |
| SD | BERESFORD | 57004 | BUTTE | HRS | 72 |
| SD | BERESFORD | 57004 | GUARD | HRS | 63 |
| SD | BERESFORD | 57004 | LEN | HRS | 71 |
| SD | BERESFORD | 57004 | MARSHALL | HRS | 65 |
| SD | BERESFORD | 57004 | PIONEER-2369 | HRS | 72 |
| SD | BROOKINGS | 57006 | BUTTE-86 | HRS | 86 |
| SD | BROOKINGS | 57006 | DAWN | HRW | 59 |
| SD | BROOKINGS | 57006 | GUARD | HRS | 76 |
| SD | BROOKINGS | 57006 | LEN | HRS | 87 |
| SD | BROOKINGS | 57006 | MARSHALL | HRS | 77 |
| SD | BROOKINGS | 57006 | REDLAND | HRW | 59 |
| SD | BROOKINGS | 57006 | ROSE | HRW | 66 |
| SD | BROOKINGS | 57006 | ROUGH RIDER | HRW | 67 |
| SD | BROOKINGS | 57006 | SCOUT-66 | HRW | 64 |
| SD | BROOKINGS | 57006 | SIOUXLAND | HRW | 59 |
| SD | BROOKINGS | 57006 | STOA | HRS | 85 |
| SD | HIGHMORE | 57345 | BUTTE-86 | HRS | 79 |
| SD | HIGHMORE | 57345 | GUARD | HRS | 65 |
| SD | HIGHMORE | 57345 | LEN | HRS | 82 |
| SD | HIGHMORE | 57345 | MARSHALL | HRS | 74 |
| SD | HIGHMORE | 57345 | PIONEER-2369 | HRS | 77 |
| SD | HIGHMORE | 57345 | REDLAND | HRW | 52 |
| SD | HIGHMORE | 57345 | ROSE | HRW | 61 |
| SD | HIGHMORE | 57345 | ROUGH RIDER | HRW | 62 |
| SD | HIGHMORE | 57345 | SCOUT-66 | HRW | 62 |
| SD | HIGHMORE | 57345 | SIOUXLAND | HRW | 58 |
| SD | HIGHMORE | 57345 | STOA | HRS | 77 |
| SD | HIGHMORE | 57345 | DAWN | HRW | 59 |
| SD | HIGHMORE | 57345 | REDLAND | HRW | 51 |
| SD | HIGHMORE | 57345 | ROSE | HRW | 59 |
| SD | HIGHMORE | 57345 | ROUGH RIDER | HRW | 63 |
| SD | HIGHMORE | 57345 | SCOUT-66 | HRW | 67 |
| SD | HIGHMORE | 57345 | SIOUXLAND | HRW | 54 |
| SD | HIGHMORE | 57345 | DAWN | HRW | 49 |
| SD | HIGHMORE | 57345 | DAWN | HRW | 55 |

TABLE 2. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|------------|---------|--------------|-------|----------|
| SD | PRESHO | 57568 | REDLAND | HRW | 50 |
| SD | PRESHO | 57568 | ROSE | HRW | 57 |
| SD | PRESHO | 57568 | ROUGH RIDER | HRW | 58 |
| SD | SELBY | 57472 | BUTTE-86 | HRS | 83 |
| SD | SELBY | 57472 | GUARD | HRS | 68 |
| SD | SELBY | 57472 | MARSHALL | HRS | 71 |
| SD | SELBY | 57472 | PIONEER-2364 | HRS | 79 |
| SD | SELBY | 57472 | STOA | HRS | 64 |
| TX | CHILICOTHE | 76384 | CENTURY | HRW | 56 |
| TX | CHILICOTHE | 76384 | COLLIN | HRW | 29 |
| TX | CHILICOTHE | 76384 | HAWK | HRW | 60 |
| TX | CHILICOTHE | 76384 | KARL | HRW | 69 |
| TX | CHILICOTHE | 76384 | MESA | HRW | 72 |
| TX | CHILICOTHE | 76384 | MUSTANG | HRW | 59 |
| TX | CHILICOTHE | 76384 | NK-PRO-812 | HRW | 74 |
| TX | CHILICOTHE | 76384 | SCOUT-66 | HRW | 65 |
| TX | CHILICOTHE | 76384 | SIOUXLAND | HRW | 62 |
| TX | CHILICOTHE | 76384 | TAM-101 | HRW | 52 |
| TX | CHILICOTHE | 76384 | TAM-105 | HRW | 63 |
| TX | CHILICOTHE | 76384 | TAM-107 | HRW | 74 |
| TX | CHILICOTHE | 76384 | TAM-108 | HRW | 39 |
| TX | CHILICOTHE | 76384 | TAM-200 | HRW | 73 |
| TX | CHILICOTHE | 76384 | TAM-201 | HRW | 67 |
| TX | MUNDAY | 76301 | CENTURY | HRW | 63 |
| TX | MUNDAY | 76301 | CHISHOLM | HRW | 33 |
| TX | MUNDAY | 76301 | COLLIN | HRW | 26 |
| TX | MUNDAY | 76301 | HAWK | HRW | 70 |
| TX | MUNDAY | 76301 | KARL | HRW | 62 |
| TX | MUNDAY | 76301 | MESA | HRW | 62 |
| TX | MUNDAY | 76301 | MUSTANG | HRW | 63 |
| TX | MUNDAY | 76301 | NK-PRO-812 | HRW | 74 |
| TX | MUNDAY | 76301 | SCOUT-66 | HRW | 66 |
| TX | MUNDAY | 76301 | SIOUXLAND | HRW | 67 |
| TX | MUNDAY | 76301 | TAM-101 | HRW | 57 |
| TX | MUNDAY | 76301 | TAM-105 | HRW | 65 |
| TX | MUNDAY | 76301 | TAM-107 | HRW | 74 |
| TX | MUNDAY | 76301 | TAM-200 | HRW | 72 |
| TX | MUNDAY | 76301 | TAM-201 | HRW | 73 |
| TX | OLNEY | 76374 | CENTURY | HRW | 54 |
| TX | OLNEY | 76374 | CHISHOLM | HRW | 32 |
| TX | OLNEY | 76374 | COLLIN | HRW | 22 |
| TX | OLNEY | 76374 | KARL | HRW | 54 |
| TX | OLNEY | 76374 | MESA | HRW | 58 |
| TX | OLNEY | 76374 | NK-PRO-812 | HRW | 63 |
| TX | OLNEY | 76374 | SCOUT-66 | HRW | 63 |
| TX | OLNEY | 76374 | SIOUXLAND | HRW | 59 |
| TX | OLNEY | 76374 | TAM-101 | HRW | 53 |
| TX | OLNEY | 76374 | TAM-105 | HRW | 66 |
| TX | OLNEY | 76374 | TAM-107 | HRW | 59 |
| TX | OLNEY | 76374 | TAM-108 | HRW | 43 |
| TX | OLNEY | 76374 | TAM-200 | HRW | 65 |

TABLE 2. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY LOCATION.

| STATE | REGION | ZIPCODE | VARIETY | CLASS | HARDNESS |
|-------|---------|---------|-----------|-------|----------|
| TX | OLNEY | 76374 | TAM-201 | HRW | 55 |
| TX | TOLBERT | 76384 | CHISHOLM | HRW | 30 |
| TX | TOLBERT | 76384 | COLLIN | HRW | 25 |
| TX | TOLBERT | 76384 | HAWK | HRW | 73 |
| TX | TOLBERT | 76384 | KARL | HRW | 53 |
| TX | TOLBERT | 76384 | MESA | HRW | 64 |
| TX | TOLBERT | 76384 | MUSTANG | HRW | 52 |
| TX | TOLBERT | 76384 | SCOUT-66 | HRW | 67 |
| TX | TOLBERT | 76384 | SIOUXLAND | HRW | 62 |
| TX | TOLBERT | 76384 | TAM-101 | HRW | 63 |
| TX | TOLBERT | 76384 | TAM-105 | HRW | 73 |
| TX | TOLBERT | 76384 | TAM-107 | HRW | 70 |
| TX | TOLBERT | 76384 | TAM-108 | HRW | 42 |
| TX | TOLBERT | 76384 | TAM-200 | HRW | 64 |
| TX | TOLBERT | 76384 | TAM-201 | HRW | 69 |

TABLE 3. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|-------------|-------|--------------|-------|---------|----------|
| 40A-DYNASTY | SRW | S-CHARLESTON | OH | 45368 | 22 |
| 906-R | HRS | RALEIGH | ND | 58564 | 74 |
| ABILENE | HRW | SUBLETTE | KS | 67877 | 74 |
| ABILENE | HRW | RYUS | KS | 67870 | 76 |
| AGRI-PRO | HRW | CHANUTE | KS | 66720 | 52 |
| AGRI-PRO | HRW | WHITE-CLOUD | KS | 66094 | 81 |
| ALEX | HRS | BEULAH | ND | 58523 | 83 |
| ALEX | HRS | BEULAH | ND | 58523 | 85 |
| ALEX | HRS | TOLLEY | ND | 58787 | 86 |
| ALEX | HRS | BEULAH | ND | 58523 | 92 |
| ANZA | HRW | GERBER | CA | 96035 | 66 |
| ANZA | HRW | ARBUCKLE | CA | 95912 | 68 |
| ANZA | HRW | ARBUCKLE | CA | 95912 | 69 |
| ANZA | HRW | DAVIS | CA | 95616 | 73 |
| ANZA | HRW | ARBUCKLE | CA | 95912 | 73 |
| ANZA | HRW | CLARKSBURG | CA | 95612 | 73 |
| ANZA | HRW | ARBUCKLE | CA | 95912 | 75 |
| ANZA | HRW | WALNUT-GROVE | CA | 95690 | 75 |
| ANZA | HRW | PALERNEO | CA | 95968 | 76 |
| ANZA | HRW | CLARKSBURG | CA | 95612 | 76 |
| ANZA | HRW | WOODLAND | CA | 95695 | 77 |
| ANZA | HRW | CHICO | CA | 95926 | 77 |
| ANZA | HRW | VACAVILLE | CA | 95688 | 77 |
| ANZA | HRW | WOODLAND | CA | 95695 | 77 |
| ANZA | HRW | WALNUT-GROVE | CA | 95690 | 78 |
| ANZA | HRW | WALNUT-GROVE | CA | 95690 | 83 |
| ANZA | HRW | WOODLAND | CA | 95695 | 84 |
| APEX | HRS | COLFAX | ND | 58018 | 69 |
| ARKAN | HRW | CANTON | KS | 67428 | 49 |
| ARKAN | HRW | TAMPA | KS | 67483 | 49 |
| ARKAN | HRW | CANTON | KS | 67428 | 52 |
| ARKAN | HRW | PRESCOTT | KS | 66767 | 53 |
| ARKAN | HRW | GENESEO | KS | 67444 | 53 |
| ARKAN | HRW | CANTON | KS | 67428 | 54 |
| ARKAN | HRW | MINNEAPOLIS | KS | 67467 | 54 |
| ARKAN | HRW | MINNEAPOLIS | KS | 67467 | 55 |
| ARKAN | HRW | CHERRYVALE | KS | 67335 | 55 |
| ARKAN | HRW | OSAGE-CITY | KS | 66523 | 55 |
| ARKAN | HRW | MANHATTAN | KS | 66502 | 55 |
| ARKAN | HRW | BLUFF-CITY | KS | 67018 | 56 |
| ARKAN | HRW | PRESCOTT | KS | 66767 | 56 |
| ARKAN | HRW | CHANUTE | KS | 66720 | 56 |
| ARKAN | HRW | LONGFORD | KS | 67458 | 57 |
| ARKAN | HRW | CHANUTE | KS | 66720 | 57 |
| ARKAN | HRW | CHANUTE | KS | 66720 | 57 |
| ARKAN | HRW | CHERRYVALE | KS | 67335 | 57 |
| ARKAN | HRW | HIAWATHA | KS | 66434 | 57 |
| ARKAN | HRW | EUREKA | KS | 67045 | 58 |
| ARKAN | HRW | GENESEO | KS | 67444 | 58 |
| ARKAN | HRW | EUREKA | KS | 67045 | 58 |
| ARKAN | HRW | MANHATTAN | KS | 66502 | 58 |

TABLE 3. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|---------|-------|--------------|-------|---------|----------|
| ARKAN | HRW | AFTON | OK | 74331 | 59 |
| ARKAN | HRW | GENESEO | KS | 67444 | 60 |
| ARKAN | HRW | LORRAINE | KS | 67459 | 60 |
| ARKAN | HRW | CANTON | KS | 67428 | 60 |
| ARKAN | HRW | LORRAINE | KS | 67459 | 60 |
| ARKAN | HRW | OSAGE-CITY | KS | 66523 | 60 |
| ARKAN | HRW | TAMPA | KS | 67483 | 60 |
| ARKAN | HRW | ST-JOHN | KS | 67576 | 61 |
| ARKAN | HRW | EUREKA | KS | 67045 | 61 |
| ARKAN | HRW | OSAGE-CITY | KS | 66523 | 61 |
| ARKAN | HRW | HARDTNER | KS | 67057 | 62 |
| ARKAN | HRW | ONAGA | KS | 66521 | 62 |
| ARKAN | HRW | ANTHONY | KS | 67003 | 62 |
| ARKAN | HRW | GENESEO | KS | 67444 | 62 |
| ARKAN | HRW | LORRAINE | KS | 67459 | 62 |
| ARKAN | HRW | BLUE-RAPIDS | KS | 66411 | 62 |
| ARKAN | HRW | MINNEAPOLIS | KS | 67467 | 62 |
| ARKAN | HRW | WHITE-CLOUD | KS | 66094 | 62 |
| ARKAN | HRW | EUREKA | KS | 67045 | 62 |
| ARKAN | HRW | BURDICK | KS | 66838 | 63 |
| ARKAN | HRW | GENESEO | KS | 67444 | 63 |
| ARKAN | HRW | ASHERVILLE | KS | 67420 | 63 |
| ARKAN | HRW | EUREKA | KS | 67045 | 63 |
| ARKAN | HRW | HIAWATHA | KS | 66434 | 64 |
| ARKAN | HRW | LINCOLN | KS | 67455 | 64 |
| ARKAN | HRW | DILLWYN | KS | 67557 | 64 |
| ARKAN | HRW | OSAGE-CITY | KS | 66523 | 64 |
| ARKAN | HRW | LINCOLN | KS | 67455 | 65 |
| ARKAN | HRW | LINCOLN | KS | 67455 | 65 |
| ARKAN | HRW | HOLTON | KS | 66436 | 65 |
| ARKAN | HRW | HOLTON | KS | 66436 | 66 |
| ARKAN | HRW | ONAGA | KS | 66521 | 66 |
| ARKAN | HRW | MANHATTAN | KS | 66502 | 66 |
| ARKAN | HRW | ONAGA | KS | 66521 | 66 |
| ARKAN | HRW | WHITE-CLOUD | KS | 66094 | 67 |
| ARKAN | HRW | BLUE-RAPIDS | KS | 66411 | 67 |
| ARKAN | HRW | HIAWATHA | KS | 66434 | 67 |
| ARKAN | HRW | OSAGE-CITY | KS | 66523 | 67 |
| ARKAN | HRW | LINCOLN | KS | 67455 | 68 |
| ARKAN | HRW | EUREKA | KS | 67045 | 68 |
| ARKAN | HRW | CUNNINGHAM | KS | 67035 | 68 |
| ARKAN | HRW | WELLINGTON | KS | 67152 | 68 |
| ARKAN | HRW | EUREKA | KS | 67045 | 69 |
| ARKAN | HRW | CHERRYVALE | KS | 67335 | 70 |
| ARKAN | HRW | PHILLIPSBURG | KS | 67661 | 73 |
| ARKAN | HRW | HOLTON | KS | 66436 | 76 |
| ARKAN | HRW | HIAWATHA | KS | 66434 | 78 |
| AUBURN | SRW | WAYLAND | MO | 63472 | 33 |
| BACA | HRW | VILAS | CO | 81087 | 56 |
| BACA | HRW | VILAS | CO | 81087 | 59 |
| --- | HRW | VILAS | CO | 81087 | 61 |

TABLE 3. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|-----------|-------|--------------|-------|---------|----------|
| ✓ | HRW | RUSH | CO | 80833 | 63 |
| ✓ER | SRW | PICKERINGTON | OH | 43147 | 17 |
| ✓ER | SRW | S-CHARLESTON | OH | 45368 | 20 |
| ✓ER | SRW | S-CHARLESTON | OH | 45368 | 21 |
| ✓ER | SRW | COLUMBUS | OH | 43201 | 23 |
| ✓ER | SRW | WINCHESTER | OH | 45697 | 24 |
| NTY | HRW | HIAWATHA | KS | 66434 | 84 |
| NTY-205 | HRW | LEOTI | KS | 67861 | 35 |
| NTY-205 | HRW | LEOTI | KS | 67861 | 39 |
| NZE-CHIEF | HRS | THREE-FORKS | MT | 59752 | 72 |
| LE | HRW | IDALIA | CO | 80735 | 46 |
| LE | HRW | PEETZ | CO | 80747 | 53 |
| LE | HRW | CHAPPELL | NE | 69129 | 54 |
| LE | HRW | CHAPPELL | NE | 69129 | 55 |
| LE | HRW | GURLEY | NE | 69141 | 55 |
| LE | HRW | CHAPPELL | NE | 69129 | 56 |
| LE | HRW | HEMINGFORD | NE | 69348 | 58 |
| LE | HRW | SIDNEY | NE | 69162 | 59 |
| LE | HRW | GORDON | NE | 69343 | 61 |
| LE | HRW | IDALIA | CO | 80735 | 61 |
| LE | HRW | PEETZ | CO | 80747 | 62 |
| LE | HRW | SIDNEY | NE | 69162 | 63 |
| LE | HRW | SIDNEY | NE | 69162 | 64 |
| LE | HRW | GURLEY | NE | 69141 | 69 |
| LE | HRW | GOODLAND | KS | 67735 | 69 |
| LE | HRW | KIMBALL | NE | 69145 | 69 |
| LE | HRW | PEETZ | CO | 80747 | 74 |
| ✓SKIN | HRW | KIMBALL | NE | 69145 | 68 |
| ✓SKIN | HRW | HEMINGFORD | NE | 69348 | 70 |
| ✓SKIN | HRW | ALLIANCE | NE | 69301 | 72 |
| ✓SKIN | HRW | ALLIANCE | NE | 69301 | 72 |
| FE | HRS | BINFORD | ND | 58416 | 96 |
| FE-86 | HRS | GRAFTON | ND | 58237 | 69 |
| FE-86 | HRS | BINFORD | ND | 58416 | 76 |
| FE-86 | HRS | GRAFTON | ND | 58237 | 78 |
| FE-86 | HRS | CARRINGTON | ND | 58421 | 80 |
| FE-86 | HRS | LARIMORE | ND | 58251 | 82 |
| FE-86 | HRS | HUNTER | ND | 58048 | 83 |
| FE-86 | HRS | CARRINGTON | ND | 58421 | 84 |
| FE-86 | HRS | KARLSTAD | MN | 56732 | 84 |
| FE-86 | HRS | FORMAN | ND | 58032 | 85 |
| FE-86 | HRS | KARLSTAD | MN | 56732 | 86 |
| FE-86 | HRS | ST-HILAIRE | MN | 56554 | 87 |
| FE-86 | HRS | KARLSTAD | MN | 56732 | 87 |
| FE-86 | HRS | PLENTYWOOD | MT | 59254 | 88 |
| FE-86 | HRS | COLFAX | ND | 58018 | 88 |
| FE-86 | HRS | JAMESTOWN | ND | 58401 | 88 |
| FE-86 | HRS | KARLSTAD | MN | 56732 | 89 |
| FE-86 | HRS | ALSEN | ND | 58311 | 90 |
| FE-86 | HRS | CARRINGTON | ND | 58421 | 90 |
| FE-86 | HRS | ST-HILAIRE | MN | 56554 | 90 |

TABLE 3. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|----------|-------|--------------|-------|---------|----------|
| BUTTE-86 | HRS | BINFORD | ND | 58416 | 90 |
| BUTTE-86 | HRS | NECHE | ND | 58265 | 91 |
| BUTTE-86 | HRS | TOLLEY | ND | 58787 | 92 |
| BUTTE-86 | HRS | COLFAX | ND | 58018 | 93 |
| BUTTE-86 | HRS | CARRINGTON | ND | 58421 | 93 |
| BUTTE-86 | HRS | CARRINGTON | ND | 58421 | 93 |
| BUTTE-86 | HRS | NECHE | ND | 58265 | 94 |
| BUTTE-86 | HRS | HUNTER | ND | 58048 | 94 |
| BUTTE-86 | HRS | CARRINGTON | ND | 58421 | 95 |
| BUTTE-86 | HRS | STIRUM | ND | 58069 | 95 |
| BUTTE-86 | HRS | FORMAN | ND | 58032 | 95 |
| BUTTE-86 | HRS | COLFAX | ND | 58018 | 96 |
| BUTTE-86 | HRS | HUNTER | ND | 58048 | 97 |
| BUTTE-86 | HRS | NECHE | ND | 58265 | 98 |
| CALDWELL | SRW | PETTIS-CO | MO | 65334 | 14 |
| CALDWELL | SRW | PETTIS-CO | MO | 65334 | 21 |
| CALDWELL | SRW | CHERRYVALE | KS | 67335 | 22 |
| CALDWELL | SRW | CROTON | OH | 43013 | 22 |
| CALDWELL | SRW | CHERRYVALE | KS | 67335 | 25 |
| CALDWELL | SRW | TRENTON | MO | 64683 | 25 |
| CALDWELL | SRW | BUTLER | OH | 44822 | 25 |
| CALDWELL | SRW | S-CHARLESTON | OH | 45368 | 26 |
| CALDWELL | SRW | BUTLER | OH | 44822 | 27 |
| CALDWELL | SRW | SALINE-CO | MO | 65340 | 27 |
| CALDWELL | SRW | S-CHARLESTON | OH | 45368 | 28 |
| CALDWELL | SRW | PATASKALA | OH | 43062 | 29 |
| CALDWELL | SRW | NEWARK | OH | 43093 | 29 |
| CALDWELL | SRW | TRENTON | MO | 64683 | 30 |
| CALDWELL | SRW | TRENTON | MO | 64683 | 30 |
| CALDWELL | SRW | S-CHARLESTON | OH | 45368 | 31 |
| CALDWELL | SRW | TRENTON | MO | 64683 | 31 |
| CALDWELL | SRW | WAYLAND | MO | 63472 | 32 |
| CALDWELL | SRW | AFTON | OK | 74331 | 32 |
| CALDWELL | SRW | TRENTON | MO | 64683 | 32 |
| CALDWELL | SRW | TRENTON | MO | 64683 | 32 |
| CARDINAL | SRW | S-CHARLESTON | OH | 45368 | 21 |
| CARDINAL | SRW | PREBLE | OH | 45347 | 22 |
| CARDINAL | SRW | S-CHARLESTON | OH | 45368 | 23 |
| CARDINAL | SRW | PREBLE | OH | 45347 | 24 |
| CARSON | HRW | LIMON | CO | 80828 | 65 |
| CARSON | HRW | OTIS | CO | 80743 | 68 |
| CELTIC | HRS | LARIMORE | ND | 58251 | 80 |
| CELTIC | HRS | HALLOCK | MN | 56728 | 81 |
| CENTURA | HRW | ALLIANCE | NE | 69301 | 51 |
| CENTURA | HRW | ALLIANCE | NE | 69301 | 53 |
| CENTURA | HRW | ALLIANCE | NE | 69301 | 55 |
| CENTURA | HRW | DIX | NE | 69133 | 56 |
| CENTURA | HRW | CHAPPELL | NE | 69129 | 59 |
| CENTURA | HRW | CHAPPELL | NE | 69129 | 59 |
| CENTURA | HRW | GURLEY | NE | 69141 | 62 |
| CENTURA | HRW | GURLEY | NE | 69141 | 63 |

TABLE 3. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|------------|-------|-------------|-------|---------|----------|
| CENTURA | HRW | SIDNEY | NE | 69162 | 64 |
| CENTURA | HRW | GORDON | NE | 69343 | 64 |
| CENTURA | HRW | VENANGO | NE | 69168 | 64 |
| CENTURA | HRW | VENANGO | NE | 69168 | 66 |
| CENTURA | HRW | CHAPPELL | NE | 69129 | 71 |
| CENTURA | HRW | GURLEY | NE | 69141 | 72 |
| CENTURA | HRW | HEMINGFORD | NE | 69348 | 73 |
| CENTURA | HRW | GURLEY | NE | 69141 | 73 |
| CENTURA | HRW | KIMBALL | NE | 69145 | 73 |
| CENTURA | HRW | GURLEY | NE | 69141 | 79 |
| CENTURK | HRW | SIDNEY | NE | 69162 | 54 |
| CENTURK | HRW | GURLEY | NE | 69141 | 57 |
| CENTURK | HRW | KIMBALL | NE | 69145 | 76 |
| CENTURK-78 | HRW | GURLEY | NE | 69141 | 64 |
| CENTURK-78 | HRW | SEWARD | KS | 67577 | 64 |
| CENTURK-78 | HRW | DIX | NE | 69133 | 70 |
| CENTURK-78 | HRW | SIDNEY | NE | 69162 | 73 |
| CHENEY | HRW | GENESEO | KS | 67444 | 72 |
| CHEYENNE | HRW | VENANGO | NE | 69168 | 61 |
| CHISHOLM | HRW | STILLWATER | OK | 74076 | 33 |
| CHISHOLM | HRW | WOODWARD | OK | 73801 | 34 |
| CHISHOLM | HRW | KINGFISHER | OK | 73750 | 35 |
| CHISHOLM | HRW | BISON | OK | 73720 | 36 |
| CHISHOLM | HRW | PONCA-CITY | OK | 74601 | 36 |
| CHISHOLM | HRW | KINGFISHER | OK | 73750 | 38 |
| CHISHOLM | HRW | KINGFISHER | OK | 73750 | 38 |
| CHISHOLM | HRW | STILLWATER | OK | 74076 | 38 |
| CHISHOLM | HRW | PONCA-CITY | OK | 74601 | 40 |
| CHISHOLM | HRW | WOODWARD | OK | 73801 | 40 |
| CHISHOLM | HRW | WOODWARD | OK | 73802 | 40 |
| CHISHOLM | HRW | WEATHERFORD | OK | 73096 | 40 |
| CHISHOLM | HRW | HARDTNER | KS | 67057 | 40 |
| CHISHOLM | HRW | FREDERICK | OK | 73542 | 40 |
| CHISHOLM | HRW | PONCA-CITY | OK | 74601 | 40 |
| CHISHOLM | HRW | BISON | OK | 73720 | 40 |
| CHISHOLM | HRW | STILLWATER | OK | 74076 | 40 |
| CHISHOLM | HRW | KINGFISHER | OK | 73750 | 41 |
| CHISHOLM | HRW | PONCA-CITY | OK | 74601 | 41 |
| CHISHOLM | HRW | PONCA-CITY | OK | 74601 | 41 |
| CHISHOLM | HRW | BISON | OK | 73720 | 41 |
| CHISHOLM | HRW | BISON | OK | 73720 | 41 |
| CHISHOLM | HRW | WOODWARD | OK | 73801 | 41 |
| CHISHOLM | HRW | CHICKASHA | OK | 73015 | 41 |
| CHISHOLM | HRW | FREDERICK | OK | 73542 | 41 |
| CHISHOLM | HRW | MEDFORD | OK | 73759 | 42 |
| CHISHOLM | HRW | STILLWATER | OK | 74076 | 42 |
| CHISHOLM | HRW | KINGFISHER | OK | 73750 | 42 |
| CHISHOLM | HRW | WEATHERFORD | OK | 73096 | 42 |
| CHISHOLM | HRW | PONCA-CITY | OK | 74601 | 42 |
| CHISHOLM | HRW | STILLWATER | OK | 74076 | 42 |
| CHISHOLM | HRW | STILLWATER | OK | 74076 | 43 |

TABLE 3. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNE |
|----------|-------|-------------|-------|---------|--------|
| CHISHOLM | HRW | FREDERICK | OK | 73542 | 43 |
| CHISHOLM | HRW | PONCA-CITY | OK | 74601 | 43 |
| CHISHOLM | HRW | BISON | OK | 73720 | 43 |
| CHISHOLM | HRW | CHICKASHA | OK | 73015 | 43 |
| CHISHOLM | HRW | CHICKASHA | OK | 73015 | 43 |
| CHISHOLM | HRW | STILLWATER | OK | 74076 | 43 |
| CHISHOLM | HRW | FREDERICK | OK | 73542 | 43 |
| CHISHOLM | HRW | WEATHERFORD | OK | 73096 | 43 |
| CHISHOLM | HRW | BISON | OK | 73720 | 43 |
| CHISHOLM | HRW | WEATHERFORD | OK | 73096 | 43 |
| CHISHOLM | HRW | WOODWARD | OK | 73802 | 43 |
| CHISHOLM | HRW | AFTON | OK | 74331 | 44 |
| CHISHOLM | HRW | KINGFISHER | OK | 73750 | 44 |
| CHISHOLM | HRW | PONCA-CITY | OK | 74601 | 44 |
| CHISHOLM | HRW | WOODWARD | OK | 73802 | 44 |
| CHISHOLM | HRW | BISON | OK | 73720 | 44 |
| CHISHOLM | HRW | FREDERICK | OK | 73542 | 44 |
| CHISHOLM | HRW | FREDERICK | OK | 73542 | 44 |
| CHISHOLM | HRW | KINGFISHER | OK | 73750 | 44 |
| CHISHOLM | HRW | BISON | OK | 73720 | 44 |
| CHISHOLM | HRW | FREDERICK | OK | 73542 | 44 |
| CHISHOLM | HRW | FREDERICK | OK | 73542 | 44 |
| CHISHOLM | HRW | STILLWATER | OK | 74076 | 44 |
| CHISHOLM | HRW | KINGFISHER | OK | 73750 | 45 |
| CHISHOLM | HRW | AFTON | OK | 74331 | 45 |
| CHISHOLM | HRW | AFTON | OK | 74331 | 45 |
| CHISHOLM | HRW | MEDFORD | OK | 73759 | 45 |
| CHISHOLM | HRW | CHICKASHA | OK | 73015 | 45 |
| CHISHOLM | HRW | BISON | OK | 73720 | 46 |
| CHISHOLM | HRW | CHICKASHA | OK | 73015 | 47 |
| CHISHOLM | HRW | CHICKASHA | OK | 73015 | 47 |
| CHISHOLM | HRW | WEATHERFORD | OK | 73096 | 47 |
| CHISHOLM | HRW | CHICKASHA | OK | 73015 | 47 |
| CHISHOLM | HRW | BISON | OK | 73720 | 48 |
| CHISHOLM | HRW | CHICKASHA | OK | 73015 | 48 |
| CHISHOLM | HRW | MEDFORD | OK | 73759 | 48 |
| CHISHOLM | HRW | PONCA-CITY | OK | 74601 | 48 |
| CHISHOLM | HRW | AFTON | OK | 74331 | 48 |
| CHISHOLM | HRW | WOODWARD | OK | 73801 | 48 |
| CHISHOLM | HRW | AFTON | OK | 74331 | 48 |
| CHISHOLM | HRW | WEATHERFORD | OK | 73096 | 51 |
| CHISHOLM | HRW | STILLWATER | OK | 74076 | 51 |
| CHISHOLM | HRW | CHICKASHA | OK | 73015 | 51 |
| CHISHOLM | HRW | KINGFISHER | OK | 73750 | 51 |
| CHISHOLM | HRW | AFTON | OK | 74331 | 51 |
| CHISHOLM | HRW | WEATHERFORD | OK | 73096 | 51 |
| CHISHOLM | HRW | WEATHERFORD | OK | 73096 | 51 |
| CHISHOLM | HRW | PONCA-CITY | OK | 74601 | 51 |
| CHISHOLM | HRW | AFTON | OK | 74331 | 51 |
| CHISHOLM | HRW | WEATHERFORD | OK | 73096 | 51 |
| CHISHOLM | HRW | AFTON | OK | 74331 | 51 |

TABLE 3. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|----------|-------|--------------|-------|---------|----------|
| CHISHOLM | HRW | CHICKASHA | OK | 73015 | 52 |
| CHISHOLM | HRW | WEATHERFORD | OK | 73096 | 53 |
| CHISHOLM | HRW | AFTON | OK | 74331 | 56 |
| CHISHOLM | HRW | WOODWARD | OK | 73802 | 58 |
| CHISHOLM | HRW | KINGFISHER | OK | 73750 | 59 |
| CHISHOLM | HRW | WOODWARD | OK | 73801 | 60 |
| CHISHOLM | HRW | AFTON | OK | 74331 | 64 |
| CHISHOLM | HRW | STILLWATER | OK | 74076 | 67 |
| CHISHOLM | HRW | WOODWARD | OK | 73801 | 71 |
| CODY | HRW | GORDON | NE | 69343 | 45 |
| CODY | HRW | CHAPPELL | NE | 69129 | 51 |
| CODY | HRW | VENANGO | NE | 69168 | 60 |
| CODY | HRW | KIMBALL | NE | 69145 | 62 |
| CODY | HRW | HEMINGFORD | NE | 69348 | 69 |
| COLT | HRW | ALLIANCE | NE | 69301 | 46 |
| COLT | HRW | ALLIANCE | NE | 69301 | 46 |
| COLT | HRW | SIDNEY | NE | 69162 | 47 |
| COLT | HRW | ALLIANCE | NE | 69301 | 47 |
| COLT | HRW | CHAPPELL | NE | 69129 | 48 |
| COLT | HRW | SIDNEY | NE | 69162 | 58 |
| COLT | HRW | HEMINGFORD | NE | 69348 | 59 |
| COLT | HRW | VENANGO | NE | 69168 | 62 |
| COLT | HRW | PHILLIPSBURG | KS | 67661 | 62 |
| COLUMBUS | HRS | BINFORD | ND | 58416 | 71 |
| COLUMBUS | HRS | BINFORD | ND | 58416 | 84 |
| COLUMBUS | HRS | CARRINGTON | ND | 58421 | 87 |
| COLUMBUS | HRS | CARRINGTON | ND | 58421 | 88 |
| COLUMBUS | HRS | TOLLEY | ND | 58787 | 103 |
| CONCHO | HRW | STILLWATER | OK | 74076 | 36 |
| CONCHO | HRW | STILLWATER | OK | 74076 | 39 |
| CONCHO | HRW | STILLWATER | OK | 74076 | 39 |
| CONCHO | HRW | STILLWATER | OK | 74076 | 40 |
| CONCHO | HRW | STILLWATER | OK | 74076 | 40 |
| CONCHO | HRW | SEWARD | KS | 67577 | 66 |
| COTEAU | HRS | RALEIGH | ND | 58564 | 81 |
| COTEAU | HRS | REGAN | ND | 58477 | 82 |
| COTEAU | HRS | REGAN | ND | 58477 | 86 |
| COTEAU | HRS | REGAN | ND | 58477 | 87 |
| COTEAU | HRS | BEULAH | ND | 58523 | 89 |
| COTEAU | HRS | CARSON | ND | 58529 | 91 |
| COTEAU | HRS | FLASHER | ND | 58535 | 91 |
| COTEAU | HRS | TOLLEY | ND | 58787 | 93 |
| COTEAU | HRS | TOLLEY | ND | 58787 | 94 |
| COTEAU | HRS | REGAN | ND | 58477 | 96 |
| CREE | HRW | BROADVIEW | MT | 59015 | 63 |
| CUTLESS | HRS | PLENTYWOOD | MT | 59254 | 81 |
| DODGE | HRW | KINGMAN | KS | 67068 | 61 |
| DYNASTY | SRW | S-CHARLESTON | OH | 45368 | 23 |
| EAGLE | HRW | OAKLEY | KS | 67748 | 67 |
| EAGLE | HRW | STANTON-CO | KS | 67855 | 68 |
| EAGLE | HRW | COLDWATER | KS | 67029 | 68 |

TABLE 3. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNE |
|------------|-------|--------------|-------|---------|--------|
| EAGLE | HRW | JETMORE | KS | 67854 | 69 |
| EAGLE | HRW | BREWSTER | KS | 67732 | 73 |
| EAGLE | HRW | LEOTI | KS | 67861 | 78 |
| EAGLE | HRW | LEOTI | KS | 67861 | 79 |
| EAGLE | HRW | OAKLEY | KS | 67748 | 80 |
| FORTUNA | HRS | DUTTON | MT | 59433 | 81 |
| FS402 | SRW | S-CHARLESTON | OH | 45368 | 25 |
| FS402 | SRW | S-CHARLESTON | OH | 45368 | 25 |
| GARST | HRW | GOODLAND | KS | 67735 | 65 |
| GARST-HR48 | HRW | RYUS | KS | 67870 | 73 |
| GARST-HR64 | HRW | ONAGA | KS | 66521 | 62 |
| GARST-HR64 | HRW | LINCOLN | KS | 67455 | 76 |
| GENIE-II | SRW | TRENTON | MO | 64683 | 29 |
| GLENMAN | HRS | DODSON | MT | 59524 | 63 |
| GLENMAN | HRS | SHELBY | MT | 59474 | 81 |
| GLENMAN | HRS | DUTTON | MT | 59433 | 81 |
| GR860 | SRW | S-CHARLESTON | OH | 45368 | 25 |
| GR860 | SRW | S-CHARLESTON | OH | 45368 | 25 |
| GR876 | SRW | S-CHARLESTON | OH | 45368 | 26 |
| GR876 | SRW | S-CHARLESTON | OH | 45368 | 30 |
| GUARD | HRS | ST-HILAIRE | MN | 56554 | 74 |
| GUARD | HRS | HAWLEY | MN | 56549 | 75 |
| GUERT-2 | HRW | DODSON | MT | 59524 | 64 |
| HAIL | HRW | PEETZ | CO | 80747 | 58 |
| HART | SRW | COLUMBUS | OH | 43201 | 30 |
| HAWK | HRW | GORDON | NE | 69343 | 52 |
| HAWK | HRW | PEETZ | CO | 80747 | 53 |
| HAWK | HRW | GORDON | NE | 69343 | 54 |
| HAWK | HRW | ANTHONY | KS | 67003 | 55 |
| HAWK | HRW | MINNEAPOLIS | KS | 67467 | 56 |
| HAWK | HRW | GURLEY | NE | 69141 | 58 |
| HAWK | HRW | OAKLEY | KS | 67748 | 61 |
| HAWK | HRW | IDALIA | CO | 80735 | 61 |
| HAWK | HRW | PEETZ | CO | 80747 | 61 |
| HAWK | HRW | ST-JOHN | KS | 67576 | 62 |
| HAWK | HRW | BREWSTER | KS | 67732 | 64 |
| HAWK | HRW | STANTON-CO | KS | 67855 | 64 |
| HAWK | HRW | BREWSTER | KS | 67732 | 65 |
| HAWK | HRW | LEOTI | KS | 67861 | 65 |
| HAWK | HRW | SIDNEY | NE | 69162 | 66 |
| HAWK | HRW | OTIS | CO | 80743 | 66 |
| HAWK | HRW | COLDWATER | KS | 67029 | 67 |
| HAWK | HRW | SUBLETTE | KS | 67877 | 68 |
| HAWK | HRW | LANE-CO | KS | 67839 | 68 |
| HAWK | HRW | DALTON | NE | 69131 | 68 |
| HAWK | HRW | HUTCHINSON | KS | 67504 | 69 |
| HAWK | HRW | CUNNINGHAM | KS | 67035 | 70 |
| HAWK | HRW | GURLEY | NE | 69141 | 70 |
| HAWK | HRW | LIMON | CO | 80828 | 70 |
| HAWK | HRW | KANORADO | KS | 67741 | 71 |
| HAWK | HRW | DILLWYN | KS | 67557 | 71 |

TABLE 3. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|---------|-------|--------------|-------|---------|----------|
| < | HRW | SEWARD | KS | 67577 | 71 |
| < | HRW | LANE-CO | KS | 67839 | 72 |
| < | HRW | SUBLETTE | KS | 67877 | 73 |
| < | HRW | JETMORE | KS | 67854 | 74 |
| < | HRW | SUBLETTE | KS | 67877 | 74 |
| < | HRW | HUGOTON | KS | 67951 | 74 |
| < | HRW | COPE | CO | 80812 | 75 |
| < | HRW | BLUE-RAPIDS | KS | 66411 | 75 |
| < | HRW | LEOTI | KS | 67861 | 75 |
| < | HRW | JETMORE | KS | 67854 | 77 |
| < | HRW | SATANTA | KS | 67870 | 77 |
| < | HRW | SUBLETTE | KS | 67877 | 79 |
| SSIC | HWW | DIXON | CA | 95620 | 62 |
| SSIC | HWW | DIXON | CA | 95620 | 62 |
| SSIC | HWW | DIXON | CA | 95620 | 64 |
| SSIC | HWW | DIXON | CA | 95620 | 64 |
| SSIC | HWW | DIXON | CA | 95620 | 65 |
| SSIC | HWW | DIXON | CA | 95620 | 68 |
| SSIC | HWW | DIXON | CA | 95620 | 68 |
| CER | HRW | SIDNEY | NE | 69162 | 71 |
| CER | HRW | HEMINGFORD | NE | 69348 | 78 |
| NED | HRW | GOODLAND | KS | 67735 | 62 |
| NED | HRW | LEOTI | KS | 67861 | 64 |
| NED | HRW | PARK | KS | 67751 | 65 |
| NED | HRW | LEOTI | KS | 67861 | 66 |
| NED | HRW | PHILLIPSBURG | KS | 67661 | 68 |
| NED | HRW | LIMON | CO | 80828 | 69 |
| NED | HRW | LEOTI | KS | 67861 | 69 |
| NED | HRW | LEOTI | KS | 67861 | 69 |
| NED | HRW | OAKLEY | KS | 67748 | 69 |
| NED | HRW | OAKLEY | KS | 67748 | 70 |
| NED | HRW | OAKLEY | KS | 67748 | 71 |
| NED | HRW | PARK | KS | 67751 | 71 |
| NED | HRW | SCOTT-CITY | KS | 67871 | |
| NED | HRW | SCOTT-CITY | KS | 67871 | |
| NED | HRW | JETMORE | | | |
| NED | HRW | PARK | | | |
| NED | HRW | KANO | | | |
| NED | HRW | LANE | | | |
| NED | HRW | BREW | | | |
| NED | HRW | LEOT | | | |
| NED | HRW | LEOT | | | |
| NED | HRW | LANE | | | |
| | HRS | BINF | | | |
| | HRS | BINF | | | |
| | HRS | LARK | | | |
| | HRS | JAME | | | |
| | HRS | BINF | | | |
| | HRS | COLF | | | |
| | HRS | REGA | | | |
| | HRS | RALE | | | |

TABLE 3. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|----------|-------|------------|-------|---------|----------|
| LEN | HRS | TOLLEY | ND | 58787 | 83 |
| LEN | HRS | REGAN | ND | 58477 | 85 |
| LEN | HRS | REGAN | ND | 58477 | 85 |
| LEN | HRS | TOLLEY | ND | 58787 | 86 |
| LEN | HRS | CARRINGTON | ND | 58421 | 87 |
| LEN | HRS | GWINNER | ND | 58040 | 88 |
| LEN | HRS | BINFORD | ND | 58416 | 90 |
| LEN | HRS | STIRUM | ND | 58069 | 90 |
| LEN | HRS | CARRINGTON | ND | 58421 | 90 |
| LEN | HRS | REGAN | ND | 58477 | 92 |
| LOGAN | SRW | PORTAGE | OH | 43451 | 24 |
| LOGAN | SRW | MAHONING | OH | 44609 | 26 |
| MARSHALL | HRS | WARROAD | MN | 56763 | 61 |
| MARSHALL | HRS | WARROAD | MN | 56763 | 64 |
| MARSHALL | HRS | WARROAD | MN | 56763 | 64 |
| MARSHALL | HRS | WARROAD | MN | 56763 | 68 |
| MARSHALL | HRS | WARROAD | MN | 56763 | 70 |
| MARSHALL | HRS | HAWLEY | MN | 56549 | 70 |
| MARSHALL | HRS | HANCOCK | MN | 56244 | 70 |
| MARSHALL | HRS | WARROAD | MN | 56763 | 71 |
| MARSHALL | HRS | WARROAD | MN | 56763 | 71 |
| MARSHALL | HRS | HUNTER | ND | 58048 | 71 |
| MARSHALL | HRS | LARIMORE | ND | 58251 | 71 |
| MARSHALL | HRS | KARLSTAD | MN | 56732 | 71 |
| MARSHALL | HRS | ARGYLE | MN | 56713 | 74 |
| MARSHALL | HRS | KARLSTAD | MN | 56732 | 74 |
| MARSHALL | HRS | ELDER | MN | 56523 | 75 |
| MARSHALL | HRS | ARGYLE | MN | 56713 | 76 |
| MARSHALL | HRS | LARIMORE | ND | 58251 | 76 |
| MARSHALL | HRS | KARLSTAD | MN | 56732 | 76 |
| MARSHALL | HRS | ELDER | MN | 56523 | 77 |
| MARSHALL | HRS | HANCOCK | MN | 56244 | 77 |
| MARSHALL | HRS | KARLSTAD | MN | 56732 | 77 |
| MARSHALL | HRS | LARIMORE | ND | 58251 | 78 |
| MARSHALL | HRS | ST-HILAIRE | MN | 56554 | 78 |
| MARSHALL | HRS | HAWLEY | MN | 56549 | 78 |
| MARSHALL | HRS | CYRUS | MN | 56323 | 78 |

TABLE 3. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|----------|-------|-------------|-------|---------|----------|
| MARSHALL | HRS | ELDER | MN | 56523 | 83 |
| MARSHALL | HRS | ARGYLE | MN | 56713 | 83 |
| MARSHALL | HRS | ELDER | MN | 56523 | 85 |
| MARSHALL | HRS | BEULAH | ND | 58523 | 85 |
| MARSHALL | HRS | NECHE | ND | 58265 | 86 |
| MARSHALL | HRS | ST-HILAIRE | MN | 56554 | 86 |
| MARSHALL | HRS | ELDER | MN | 56523 | 86 |
| MARSHALL | HRS | HAWLEY | MN | 56549 | 86 |
| MARSHALL | HRS | ELDER | MN | 56523 | 87 |
| MARSHALL | HRS | NECHE | ND | 58265 | 87 |
| MARSHALL | HRS | HAWLEY | MN | 56549 | 89 |
| MARSHALL | HRS | NECHE | ND | 58265 | 89 |
| MARSHALL | HRS | BEULAH | ND | 58523 | 89 |
| MARSHALL | HRS | ARGYLE | MN | 56713 | 89 |
| MARSHALL | HRS | ST-HILAIRE | MN | 56554 | 90 |
| MARSHALL | HRS | HALLOCK | MN | 56728 | 91 |
| MARSHALL | HRS | HALLOCK | MN | 56728 | 92 |
| MARSHALL | HRS | ELDER | MN | 56523 | 94 |
| MARSHALL | HRS | HALLOCK | MN | 56728 | 97 |
| MARSHALL | HRS | GRAFTON | ND | 58237 | 97 |
| MESA | HRW | OTIS | CO | 80743 | 65 |
| MESA | HRW | RYUS | KS | 67870 | 71 |
| MESA | HRW | SUBLETTE | KS | 67877 | 74 |
| MUSTANG | HRW | WEATHERFORD | OK | 73096 | 52 |
| MUSTANG | HRW | OTIS | CO | 80743 | 52 |
| MUSTANG | HRW | IDALIA | CO | 80735 | 53 |
| MUSTANG | HRW | ANTHONY | KS | 67003 | 53 |
| MUSTANG | HRW | WELLINGTON | KS | 67152 | 56 |
| MUSTANG | HRW | BLUFF-CITY | KS | 67018 | 58 |
| MUSTANG | HRW | PONCA-CITY | OK | 74601 | 60 |
| MUSTANG | HRW | COLDWATER | KS | 67029 | 60 |
| MUSTANG | HRW | GOODLAND | KS | 67735 | 60 |
| MUSTANG | HRW | WEATHERFORD | OK | 73096 | 61 |
| MUSTANG | HRW | TAH | | | |
| MUSTANG | HRW | DD | | | |
| MUSTANG | HRW | | | | |

TABLE 3. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|-------------|-------|-------------|-------|---------|----------|
| MUSTANG | HRW | JETMORE | KS | 67854 | 73 |
| MUSTANG | HRW | MANHATTAN | KS | 66502 | 75 |
| MUSTANG | HRW | HUGOTON | KS | 67951 | 75 |
| MUSTANG | HRW | HUGOTON | KS | 67951 | 82 |
| McNAIR-1003 | SRW | PRESCOTT | KS | 66767 | 25 |
| NEWANA | HRS | DODSON | MT | 59524 | 71 |
| NEWANA | HRS | GREAT-FALLS | MT | 59404 | 72 |
| NEWANA | HRS | GREAT-FALLS | MT | 59404 | 78 |
| NEWANA | HRS | THREE-FORKS | MT | 59752 | 79 |
| NEWTON | HRW | GENESEO | KS | 67444 | 52 |
| NEWTON | HRW | CANTON | KS | 67428 | 52 |
| NEWTON | HRW | SEWARD | KS | 67577 | 53 |
| NEWTON | HRW | GENESEO | KS | 67444 | 56 |
| NEWTON | HRW | LONGFORD | KS | 67458 | 56 |
| NEWTON | HRW | PARK | KS | 67751 | 56 |
| NEWTON | HRW | GENESEO | KS | 67444 | 56 |
| NEWTON | HRW | PARK | KS | 67751 | 56 |
| NEWTON | HRW | ASHERVILLE | KS | 67420 | 56 |
| NEWTON | HRW | PARK | KS | 67751 | 57 |
| NEWTON | HRW | HOLTON | KS | 66436 | 57 |
| NEWTON | HRW | LONGFORD | KS | 67458 | 57 |
| NEWTON | HRW | TAMPA | KS | 67483 | 57 |
| NEWTON | HRW | OTIS | CO | 80743 | 57 |
| NEWTON | HRW | ONAGA | KS | 66521 | 58 |
| NEWTON | HRW | BREWSTER | KS | 67732 | 58 |
| NEWTON | HRW | PARK | KS | 67751 | 60 |
| NEWTON | HRW | CUNNINGHAM | KS | 67035 | 60 |
| NEWTON | HRW | KANORADO | KS | 67741 | 60 |
| NEWTON | HRW | SEWARD | KS | 67577 | 60 |
| NEWTON | HRW | BLUE-RAPIDS | KS | 66411 | 61 |
| NEWTON | HRW | HOLTON | KS | 66436 | 61 |
| NEWTON | HRW | ST-JOHN | KS | 67576 | 61 |
| NEWTON | HRW | ONAGA | KS | 66521 | 61 |
| NEWTON | HRW | BLUE-RAPIDS | KS | 66411 | 61 |
| NEWTON | HRW | BREWSTER | KS | 67732 | 61 |
| NEWTON | HRW | MANHATTAN | KS | 66502 | 61 |
| NEWTON | HRW | LANE-CO | KS | 67839 | 62 |
| NEWTON | HRW | OAKLEY | KS | 67748 | 62 |
| NEWTON | HRW | SEWARD | KS | 67577 | 62 |
| NEWTON | HRW | ONAGA | KS | 66521 | 62 |
| NEWTON | HRW | BLUE-RAPIDS | KS | 66411 | 63 |
| NEWTON | HRW | STANTON-CO | KS | 67855 | 63 |
| NEWTON | HRW | HUGOTON | KS | 67951 | 63 |
| NEWTON | HRW | SEWARD | KS | 67577 | 63 |
| NEWTON | HRW | TAMPA | KS | 67483 | 63 |
| NEWTON | HRW | GOODLAND | KS | 67735 | 64 |
| NEWTON | HRW | OTIS | CO | 80743 | 64 |
| NEWTON | HRW | DILLWYN | KS | 67557 | 64 |
| NEWTON | HRW | GOODLAND | KS | 67735 | 64 |
| NEWTON | HRW | GOODLAND | KS | 67735 | 65 |
| NEWTON | HRW | HOLTON | KS | 66436 | 65 |

TABLE 3. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|---------------|-------|---------------|-------|---------|----------|
| NEWTON | HRW | GOODLAND | KS | 67735 | 65 |
| NEWTON | HRW | JETMORE | KS | 67854 | 65 |
| NEWTON | HRW | MANHATTAN | KS | 66502 | 66 |
| NEWTON | HRW | LEOTI | KS | 67861 | 66 |
| NEWTON | HRW | PHILLIPSBURG | KS | 67661 | 67 |
| NEWTON | HRW | MINNEAPOLIS | KS | 67467 | 69 |
| NEWTON | HRW | BLUE-RAPIDS | KS | 66411 | 70 |
| NEWTON | HRW | PHILLIPSBURG | KS | 67661 | 74 |
| NEWTON | HRW | MINNEAPOLIS | KS | 67467 | 76 |
| NEWTON | HRW | ONAGA | KS | 66521 | 76 |
| NEWTON | HRW | HIAWATHA | KS | 66434 | 77 |
| NK-711 | HRS | ST-HILAIRE | MN | 56554 | 79 |
| NK-812 | HRW | FREDERICK | OK | 73542 | 79 |
| NK-812 | HRW | FREDERICK | OK | 73542 | 85 |
| NK-830 | HRW | LINCOLN | KS | 67455 | 76 |
| NK-830 | HRW | LINCOLN | KS | 67455 | 78 |
| NORKAN | HRW | WHITE-CLOUD | KS | 66094 | 55 |
| NORKAN | HRW | VENANGO | NE | 69168 | 59 |
| NORKAN | HRW | PHILLIPSBURG | KS | 67661 | 66 |
| NORKAN | HRW | WHITE-CLOUD | KS | 66094 | 69 |
| NORSEMAN | HRS | GRAFTON | ND | 58237 | 68 |
| NORSEMAN | HRS | GRAFTON | ND | 58237 | 96 |
| NORSEMAN | HRS | GRAFTON | ND | 58237 | 103 |
| NORSEMAN | HRS | ALSEN | ND | 58311 | 104 |
| NORSTAR | HRW | DODSON | MT | 59524 | 64 |
| PARKER | HRW | CHANUTE | KS | 66720 | 64 |
| PARKER | HRW | CHANUTE | KS | 66720 | 73 |
| PIKE | SRW | SALINE-CO | MO | 65340 | 7 |
| PIKE | SRW | PETTIS-CO | MO | 65334 | 13 |
| PIKE | SRW | SALINE-CO | MO | 65340 | 13 |
| PIKE | SRW | SALINE-CO | MO | 65340 | 14 |
| PIKE | SRW | SALINE-CO | MO | 65340 | 15 |
| PIKE | SRW | TRENTON | MO | 64683 | 19 |
| PIKE | SRW | TRENTON | MO | 64683 | 21 |
| PIKE | SRW | BUTLER | OH | 44822 | 20 |
| PIONEER | SRW | PORTAGE | OH | 43451 | 23 |
| PIONEER | SRW | PLEASANTVILLE | OH | 43148 | 32 |
| PIONEER | HRW | PONCA-CITY | OK | 74601 | 49 |
| PIONEER | HRW | GOODLAND | KS | 67735 | 53 |
| PIONEER | HRW | CANTON | KS | 67428 | 53 |
| PIONEER | HRW | PONCA-CITY | OK | 74601 | 58 |
| PIONEER | HRW | KINGFISHER | OK | 73750 | 61 |
| PIONEER | HRW | KINGFISHER | OK | 73750 | 61 |
| PIONEER | HRW | AFTON | OK | 74331 | 66 |
| PIONEER | HRW | AFTON | OK | 74331 | 72 |
| PIONEER | HRW | ELDER | MN | 56523 | 88 |
| PIONEER | HRW | TOLLEY | ND | 58787 | 89 |
| PIONEER | HRW | TOLLEY | ND | 58018 | 97 |
| PIONEER-17707 | HRS | COLFAX | OK | 73096 | 47 |
| PIONEER-2157 | HRW | WEATHERFORD | OK | 73801 | 49 |
| PIONEER-2157 | HRW | WOODWARD | OK | 74331 | 50 |
| PIONEER-2157 | HRW | AFTON | OK | 74331 | 50 |

TABLE 3. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|--------------|-------|-------------|-------|---------|----------|
| PIONEER-2157 | HRW | MEDFORD | OK | 73759 | 50 |
| PIONEER-2157 | HRW | ANTHONY | KS | 67003 | 51 |
| PIONEER-2157 | HRW | AFTON | OK | 74331 | 51 |
| PIONEER-2157 | HRW | CANTON | KS | 67428 | 51 |
| PIONEER-2157 | HRW | PONCA-CITY | OK | 74601 | 54 |
| PIONEER-2157 | HRW | CHICKASHA | OK | 73015 | 54 |
| PIONEER-2157 | HRW | WOODWARD | OK | 73801 | 54 |
| PIONEER-2157 | HRW | BLUFF-CITY | KS | 67018 | 55 |
| PIONEER-2157 | HRW | HARDTNER | KS | 67057 | 55 |
| PIONEER-2157 | HRW | STILLWATER | OK | 74076 | 56 |
| PIONEER-2157 | HRW | MINNEAPOLIS | KS | 67467 | 56 |
| PIONEER-2157 | HRW | MEDFORD | OK | 73759 | 57 |
| PIONEER-2157 | HRW | BLUFF-CITY | KS | 67018 | 57 |
| PIONEER-2157 | HRW | MEDFORD | OK | 73759 | 57 |
| PIONEER-2157 | HRW | WEATHERFORD | OK | 73096 | 58 |
| PIONEER-2157 | HRW | CHICKASHA | OK | 73015 | 58 |
| PIONEER-2157 | HRW | LORRAINE | KS | 67459 | 58 |
| PIONEER-2157 | HRW | CHICKASHA | OK | 73015 | 58 |
| PIONEER-2157 | HRW | WOODWARD | OK | 73801 | 58 |
| PIONEER-2157 | HRW | KINGFISHER | OK | 73750 | 58 |
| PIONEER-2157 | HRW | BISON | OK | 73720 | 60 |
| PIONEER-2157 | HRW | STILLWATER | OK | 74076 | 60 |
| PIONEER-2157 | HRW | BISON | OK | 73720 | 60 |
| PIONEER-2157 | HRW | PONCA-CITY | OK | 74601 | 60 |
| PIONEER-2157 | HRW | MEDFORD | OK | 73759 | 60 |
| PIONEER-2157 | HRW | LORRAINE | KS | 67459 | 61 |
| PIONEER-2157 | HRW | STILLWATER | OK | 74076 | 61 |
| PIONEER-2157 | HRW | KINGFISHER | OK | 73750 | 61 |
| PIONEER-2157 | HRW | KINGFISHER | OK | 73750 | 61 |
| PIONEER-2157 | HRW | LANE-CO | KS | 67839 | 61 |
| PIONEER-2157 | HRW | WELLINGTON | KS | 67152 | 61 |
| PIONEER-2157 | HRW | PONCA-CITY | OK | 74601 | 61 |
| PIONEER-2157 | HRW | CHICKASHA | OK | 73015 | 62 |
| PIONEER-2157 | HRW | STILLWATER | OK | 74076 | 62 |
| PIONEER-2157 | HRW | STILLWATER | OK | 74076 | 62 |
| PIONEER-2157 | HRW | WOODWARD | OK | 73801 | 62 |
| PIONEER-2157 | HRW | PONCA-CITY | OK | 74601 | 63 |
| PIONEER-2157 | HRW | CHICKASHA | OK | 73015 | 64 |
| PIONEER-2157 | HRW | BISON | OK | 73720 | 64 |
| PIONEER-2157 | HRW | MEDFORD | OK | 73759 | 64 |
| PIONEER-2157 | HRW | WEATHERFORD | OK | 73096 | 64 |
| PIONEER-2157 | HRW | LORRAINE | KS | 67459 | 65 |
| PIONEER-2157 | HRW | JETMORE | KS | 67854 | 65 |
| PIONEER-2157 | HRW | WELLINGTON | KS | 67152 | 66 |
| PIONEER-2157 | HRW | WEATHERFORD | OK | 73096 | 66 |
| PIONEER-2157 | HRW | BISON | OK | 73720 | 66 |
| PIONEER-2157 | HRW | MEDFORD | OK | 73759 | 66 |
| PIONEER-2157 | HRW | BISON | OK | 73720 | 67 |
| PIONEER-2157 | HRW | WEATHERFORD | OK | 73096 | 69 |
| PIONEER-2157 | HRW | WOODWARD | OK | 73801 | 72 |
| PIONEER-2165 | HRW | LORRAINE | KS | 67459 | 66 |

TABLE 3. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|---------------|-------|-------------|-------|---------|----------|
| PIONEER-2165 | HRW | TAMPA | KS | 67483 | 67 |
| PIONEER-2172 | HRW | BLUFF-CITY | KS | 67018 | 57 |
| PIONEER-2172 | HRW | WELLINGTON | KS | 67152 | 75 |
| PIONEER-2369 | HRS | LARIMORE | ND | 58251 | 90 |
| PIONEER-2369 | HRS | ALSEN | ND | 58311 | 90 |
| PIONEER-2369 | HRS | HALLOCK | MN | 56728 | 95 |
| PIONEER-2385 | HRS | CYRUS | MN | 56323 | 76 |
| PIONEER-2385 | HRS | HALLOCK | MN | 56728 | 81 |
| PIONEER-2385 | HRS | JAMESTOWN | ND | 58401 | 81 |
| PIONEER-2385 | HRS | ALSEN | ND | 58311 | 81 |
| PIONEER-2385 | HRS | CYRUS | MN | 56323 | 85 |
| PIONEER-2385 | HRS | COLFAX | ND | 58018 | 86 |
| PIONEER-2550 | SRW | DELAWARE | OH | 43015 | 22 |
| PIONEER-5757 | HRW | TAMPA | KS | 67483 | 55 |
| PIONEER-5757 | HRW | TAMPA | KS | 67483 | 58 |
| PLAINSMAN | HRW | WELLINGTON | KS | 67152 | 67 |
| PRO-BRAND-830 | HRW | MANCHESTER | KS | 67463 | 61 |
| PRO-BRAND-830 | HRW | HIAWATHA | KS | 66434 | 64 |
| PRO-BRAND-830 | HRW | OSAGE-CITY | KS | 66523 | 65 |
| PRO-BRAND-830 | HRW | MINNEAPOLIS | KS | 67467 | 65 |
| PRO-BRAND-830 | HRW | LORRAINE | KS | 67459 | 69 |
| PRO-BRAND-830 | HRW | ASHERVILLE | KS | 67420 | 70 |
| PRO-BRAND-830 | HRW | CANTON | KS | 67428 | 72 |
| PRO-BRAND-830 | HRW | LONGFORD | KS | 67458 | 72 |
| PRO-BRAND-830 | HRW | ASHERVILLE | KS | 67420 | 73 |
| PRO-BRAND-830 | HRW | PRESCOTT | KS | 66767 | 74 |
| PRO-BRAND-830 | HRW | PRESCOTT | KS | 66767 | 76 |
| QUANTUM | HRW | RYUS | KS | 67870 | 60 |
| REDLAND | HRW | VENANGO | NE | 69168 | 47 |
| REDLAND | HRW | GURLEY | NE | 69141 | 62 |
| REDLAND | HRW | GURLEY | NE | 69141 | 64 |
| REDLAND | HRW | HEMINGFORD | NE | 69348 | 69 |
| REDWIN | HRW | THREE-FORKS | MT | 59752 | 82 |
| ROCKY | HRW | SIDNEY | NE | 69162 | 76 |
| ROCKY | HRW | HARDTNER | KS | 67057 | 77 |
| SAGE | HRW | GORDON | NE | 69343 | 43 |
| SAGE | HRW | COLDWATER | KS | 67029 | 68 |
| SANDY | HRW | PIERCE | CO | 80650 | 51 |
| SANDY | HRW | PIERCE | CO | 80650 | 52 |
| SANDY | HRW | PIERCE | CO | 80650 | 56 |
| SANDY | HRW | PIERCE | CO | 80650 | 57 |
| SANDY | HRW | PIERCE | CO | 80650 | 59 |
| SANDY | HRW | PIERCE | CO | 80650 | 64 |
| SANDY | HRW | PIERCE | CO | 80650 | 65 |
| SANDY | HRW | PIERCE | CO | 80650 | 65 |
| SANDY | HRW | PIERCE | CO | 80650 | 65 |
| SANDY | HRW | PIERCE | CO | 80650 | 65 |
| SANDY | HRW | PIERCE | CO | 80650 | 65 |
| SANDY | HRW | PEETZ | CO | 80747 | 66 |
| SANDY | HRW | PIERCE | CO | 80650 | 66 |
| SANDY | HRW | PIERCE | CO | 80650 | 67 |
| SANDY | HRW | PIERCE | CO | 80650 | 68 |

TABLE 3. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|------------|-------|-------------|-------|---------|----------|
| SANDY | HRW | PIERCE | CO | 80650 | 68 |
| SANDY | HRW | PIERCE | CO | 80650 | 71 |
| SANDY | HRW | ARRIBA | CO | 80804 | 72 |
| SANDY | HRW | STANTON-CO | KS | 67855 | 73 |
| SCOTTY | SRW | LANCASTER | OH | 43130 | 28 |
| SCOUT | HRW | DIX | NE | 69133 | 57 |
| SCOUT | HRW | PEETZ | CO | 80747 | 63 |
| SCOUT | HRW | RYUS | KS | 67870 | 68 |
| SCOUT-66 | HRW | GORDON | NE | 69343 | 49 |
| SCOUT-66 | HRW | GORDON | NE | 69343 | 51 |
| SCOUT-66 | HRW | GORDON | NE | 69343 | 58 |
| SCOUT-66 | HRW | IDALIA | CO | 80735 | 62 |
| SCOUT-66 | HRW | GORDON | NE | 69343 | 62 |
| SCOUT-66 | HRW | KIMBALL | NE | 69145 | 63 |
| SCOUT-66 | HRW | IDALIA | CO | 80735 | 65 |
| SCOUT-66 | HRW | GOODLAND | KS | 67735 | 67 |
| SCOUT-66 | HRW | JETMORE | KS | 67854 | 76 |
| SCOUT-66 | HRW | BREWSTER | KS | 67732 | 77 |
| SHIOUXLAND | HRW | GORDON | NE | 69343 | 45 |
| SHIOUXLAND | HRW | GORDON | NE | 69343 | 46 |
| SHIOUXLAND | HRW | OSAGE-CITY | KS | 66523 | 55 |
| SHIOUXLAND | HRW | GORDON | NE | 69343 | 56 |
| SHIOUXLAND | HRW | OSAGE-CITY | KS | 66523 | 57 |
| SHIOUXLAND | HRW | WOODWARD | OK | 73801 | 59 |
| SHIOUXLAND | HRW | CHAPPELL | NE | 69129 | 59 |
| SHIOUXLAND | HRW | WOODWARD | OK | 73801 | 59 |
| SHIOUXLAND | HRW | GORDON | NE | 69343 | 59 |
| SHIOUXLAND | HRW | WOODWARD | OK | 73801 | 60 |
| SHIOUXLAND | HRW | SIDNEY | NE | 69162 | 61 |
| SHIOUXLAND | HRW | HUTCHINSON | KS | 67504 | 62 |
| SHIOUXLAND | HRW | DIX | NE | 69133 | 63 |
| SHIOUXLAND | HRW | WOODWARD | OK | 73802 | 64 |
| SHIOUXLAND | HRW | SIDNEY | NE | 69162 | 64 |
| SHIOUXLAND | HRW | SIDNEY | NE | 69162 | 65 |
| SHIOUXLAND | HRW | GENESE | KS | 67444 | 66 |
| SHIOUXLAND | HRW | WOODWARD | OK | 73801 | 67 |
| SHIOUXLAND | HRW | MINNEAPOLIS | KS | 67467 | 67 |
| SHIOUXLAND | HRW | COLDWATER | KS | 67029 | 68 |
| SHIOUXLAND | HRW | HEMINGFORD | NE | 69348 | 75 |
| SOLAR-DNS | HRS | CHOTEAU | MT | 59422 | 82 |
| STALLION | HRW | OTIS | CO | 80743 | 57 |
| STALLION | HRW | WELLINGTON | KS | 67152 | 63 |
| STALLION | HRW | MEDFORD | OK | 73759 | 65 |
| STALLION | HRW | SCOTT-CITY | KS | 67871 | 66 |
| STALLION | HRW | RYUS | KS | 67870 | 70 |
| STOA | HRS | WARROAD | MN | 56763 | 64 |
| STOA | HRS | RALEIGH | ND | 58564 | 70 |
| STOA | HRS | ST-HILAIRE | MN | 56554 | 74 |
| STOA | HRS | WARROAD | MN | 56763 | 75 |
| STOA | HRS | RALEIGH | ND | 58564 | 76 |
| STOA | HRS | WARROAD | MN | 56763 | 77 |

TABLE 3. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|------------|-------|------------|-------|---------|----------|
| STOA | HRS | FORMAN | ND | 58032 | 77 |
| STOA | HRS | LISBON | ND | 58054 | 77 |
| STOA | HRS | ST-HILAIRE | MN | 56554 | 77 |
| STOA | HRS | HUNTER | ND | 58048 | 79 |
| STOA | HRS | RALEIGH | ND | 58564 | 79 |
| STOA | HRS | RALEIGH | ND | 58564 | 79 |
| STOA | HRS | REGAN | ND | 58477 | 81 |
| STOA | HRS | JAMESTOWN | ND | 58401 | 82 |
| STOA | HRS | LARIMORE | ND | 58251 | 83 |
| STOA | HRS | HAWLEY | MN | 56549 | 84 |
| STOA | HRS | HAWLEY | MN | 56549 | 84 |
| STOA | HRS | GRAFTON | ND | 58237 | 84 |
| STOA | HRS | HUNTER | ND | 58048 | 84 |
| STOA | HRS | ST-HILAIRE | MN | 56554 | 85 |
| STOA | HRS | REGAN | ND | 58477 | 85 |
| STOA | HRS | HALLOCK | MN | 56728 | 86 |
| STOA | HRS | BEULAH | ND | 58523 | 86 |
| STOA | HRS | TOLLEY | ND | 58787 | 86 |
| STOA | HRS | NECHE | ND | 58265 | 87 |
| STOA | HRS | HUNTER | ND | 58048 | 87 |
| STOA | HRS | ALSEN | ND | 58311 | 89 |
| STOA | HRS | TOLLEY | ND | 58787 | 89 |
| STOA | HRS | BEULAH | ND | 58523 | 90 |
| STOA | HRS | GRAFTON | ND | 58237 | 91 |
| STOA | HRS | NECHE | ND | 58265 | 93 |
| STOA | HRS | HUNTER | ND | 58048 | 93 |
| STOA | HRS | GWINNER | ND | 58040 | 94 |
| SUPER-HAWK | HRW | PEETZ | CO | 80747 | 50 |
| TAM-101 | HRW | ANTHONY | KS | 67003 | 55 |
| TAM-101 | HRW | KINGFISHER | OK | 73750 | 58 |
| TAM-101 | HRW | KINGFISHER | OK | 73750 | 58 |
| TAM-101 | HRW | ANTHONY | KS | 67003 | 58 |
| TAM-101 | HRW | KINGFISHER | OK | 73750 | 63 |
| TAM-105 | HRW | PRESCOTT | KS | 66767 | 44 |
| TAM-105 | HRW | PRESCOTT | KS | 66767 | 54 |
| TAM-105 | HRW | PRESCOTT | KS | 66767 | 57 |
| TAM-105 | HRW | ASHERVILLE | KS | 67420 | 60 |
| TAM-105 | HRW | PRESCOTT | KS | 66767 | 64 |
| TAM-105 | HRW | PARK | KS | 67751 | 70 |
| TAM-105 | HRW | STANTON-CO | KS | 67855 | 77 |
| TAM-105 | HRW | LEOTI | KS | 67861 | 77 |
| TAM-105 | HRW | LEOTI | KS | 67861 | 78 |
| TAM-105 | HRW | LEOTI | KS | 67861 | 79 |
| TAM-105 | HRW | LEOTI | KS | 67861 | 82 |
| TAM-105 | HRW | OSAGE-CITY | KS | 66523 | 82 |
| TAM-105 | HRW | COPE | CO | 80812 | 83 |
| TAM-105 | HRW | LEOTI | KS | 67861 | 85 |
| TAM-105 | HRW | STANTON-CO | KS | 67855 | 78 |
| TAM-106 | HRW | LINCOLN | KS | 67455 | 56 |
| TAM-107 | HRW | CHERRYVALE | KS | 67335 | 57 |
| TAM-107 | HRW | IDALIA | CO | 80735 | 66 |

TABLE 3. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|-------------|-------|--------------|-------|---------|----------|
| TAM-107 | HRW | STANTON-CO | KS | 67855 | 68 |
| TAM-107 | HRW | VENANGO | NE | 69168 | 73 |
| TAM-107 | HRW | LEOTI | KS | 67861 | 76 |
| TAM-107 | HRW | PARK | KS | 67751 | 76 |
| TAM-107 | HRW | JETMORE | KS | 67854 | 77 |
| TAM-107 | HRW | VENANGO | NE | 69168 | 77 |
| TAM-107 | HRW | HEMINGFORD | NE | 69348 | 78 |
| TAM-107 | HRW | OTIS | CO | 80743 | 79 |
| TAM-107 | HRW | LANE-CO | KS | 67839 | 79 |
| TAM-107 | HRW | HUGO | CO | 80821 | 80 |
| TAM-107 | HRW | VENANGO | NE | 69168 | 81 |
| TAM-107 | HRW | OTIS | CO | 80743 | 81 |
| TAM-107 | HRW | LEOTI | KS | 67861 | 83 |
| TAM-107 | HRW | RYUS | KS | 67870 | 84 |
| TAM-107 | HRW | OTIS | CO | 80743 | 85 |
| TAM-107 | HRW | SUBLETTE | KS | 67877 | 91 |
| TAM-108 | HRW | IDALIA | CO | 80735 | 33 |
| TAM-108 | HRW | PEETZ | CO | 80747 | 37 |
| TAM-108 | HRW | PRESCOTT | KS | 66767 | 49 |
| TAM-108 | HRW | CHERRYVALE | KS | 67335 | 50 |
| TAM-108 | HRW | DILLWYN | KS | 67557 | 55 |
| TAM-108 | HRW | ST-JOHN | KS | 67576 | 60 |
| TELEMARK | HRS | KARLSTAD | MN | 56732 | 83 |
| TELEMARK | HRS | GRAFTON | ND | 58237 | 90 |
| THUNDERBIRD | HRW | GORDON | NE | 69343 | 64 |
| THUNDERBIRD | HRW | EUREKA | KS | 67045 | 65 |
| THUNDERBIRD | HRW | GORDON | NE | 69343 | 65 |
| THUNDERBIRD | HRW | IDALIA | CO | 80735 | 66 |
| THUNDERBIRD | HRW | OTIS | CO | 80743 | 67 |
| THUNDERBIRD | HRW | BREWSTER | KS | 67732 | 68 |
| THUNDERBIRD | HRW | COLDWATER | KS | 67029 | 69 |
| THUNDERBIRD | HRW | COLDWATER | KS | 67029 | 71 |
| THUNDERBIRD | HRW | HUGOTON | KS | 67951 | 72 |
| THUNDERBIRD | HRW | PHILLIPSBURG | KS | 67661 | 74 |
| THUNDERBIRD | HRW | ASHERVILLE | KS | 67420 | 76 |
| THUNDERBIRD | HRW | WELLINGTON | KS | 67152 | 76 |
| THUNDERBIRD | HRW | WHITE-CLOUD | KS | 66094 | 79 |
| THUNDERBIRD | HRW | HUGOTON | KS | 67951 | 79 |
| THUNDERBIRD | HRW | BLUE-RAPIDS | KS | 66411 | 80 |
| THUNDERBIRD | HRW | WHITE-CLOUD | KS | 66094 | 80 |
| THUNDERBIRD | HRW | SATANTA | KS | 67870 | 81 |
| THUNDERBIRD | HRW | BREWSTER | KS | 67732 | 82 |
| TITAN | SRW | COLUMBUS | OH | 43201 | 30 |
| TRAILBLAZER | HRW | ONAGA | KS | 66521 | 59 |
| TRAILBLAZER | HRW | ASHERVILLE | KS | 67420 | 67 |
| TRIUMPH | HRW | WEATHERFORD | OK | 73096 | 46 |
| TRIUMPH | HRW | BISON | OK | 73720 | 47 |
| TRIUMPH | HRW | WEATHERFORD | OK | 73096 | 51 |
| TRIUMPH | HRW | BISON | OK | 73720 | 52 |
| TRIUMPH | HRW | BISON | OK | 73720 | 53 |
| TRIUMPH | HRW | WEATHERFORD | OK | 73096 | 54 |

TABLE 3. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|---------|-------|-------------|-------|---------|----------|
| TRIUMPH | HRW | BISON | OK | 73720 | 54 |
| TRIUMPH | HRW | KINGFISHER | OK | 73750 | 55 |
| TRIUMPH | HRW | BISON | OK | 73720 | 56 |
| TRIUMPH | HRW | CANTON | KS | 67428 | 56 |
| TRIUMPH | HRW | KINGMAN | KS | 67068 | 57 |
| TRIUMPH | HRW | EUREKA | KS | 67045 | 57 |
| TRIUMPH | HRW | CHANUTE | KS | 66720 | 59 |
| TRIUMPH | HRW | CHANUTE | KS | 66720 | 60 |
| TRIUMPH | HRW | ANTHONY | KS | 67003 | 62 |
| TRIUMPH | HRW | CHANUTE | KS | 66720 | 70 |
| TRIUMPH | HRW | MANHATTAN | KS | 66502 | 75 |
| TUT | HRW | SEWARD | KS | 67577 | 67 |
| VICTORY | HRW | CANTON | KS | 67428 | 51 |
| VICTORY | HRW | OSAGE-CITY | KS | 66523 | 55 |
| VICTORY | HRW | TAMPA | KS | 67483 | 58 |
| VICTORY | HRW | WELLINGTON | KS | 67152 | 59 |
| VICTORY | HRW | IDALIA | CO | 80735 | 60 |
| VICTORY | HRW | CHERRYVALE | KS | 67335 | 60 |
| VICTORY | HRW | LONGFORD | KS | 67458 | 61 |
| VICTORY | HRW | LORRAINE | KS | 67459 | 61 |
| VICTORY | HRW | KINGMAN | KS | 67068 | 62 |
| VICTORY | HRW | TAMPA | KS | 67483 | 62 |
| VICTORY | HRW | LANE-CO | KS | 67839 | 62 |
| VICTORY | HRW | ONAGA | KS | 66521 | 62 |
| VICTORY | HRW | MANHATTAN | KS | 66502 | 62 |
| VICTORY | HRW | EUREKA | KS | 67045 | 63 |
| VICTORY | HRW | HOLTON | KS | 66436 | 63 |
| VICTORY | HRW | DILLWYN | KS | 67557 | 64 |
| VICTORY | HRW | HARDTNER | KS | 67057 | 64 |
| VICTORY | HRW | HIAWATHA | KS | 66434 | 64 |
| VICTORY | HRW | OTIS | CO | 80743 | 65 |
| VICTORY | HRW | WHITE-CLOUD | KS | 66094 | 65 |
| VICTORY | HRW | WHITE-CLOUD | KS | 66094 | 65 |
| VICTORY | HRW | HOLTON | KS | 66436 | 65 |
| VICTORY | HRW | LIMON | CO | 80828 | 65 |
| VICTORY | HRW | HOLTON | KS | 66436 | 66 |
| VICTORY | HRW | LONGFORD | KS | 67458 | 66 |
| VICTORY | HRW | LONGFORD | KS | 67458 | 66 |
| VICTORY | HRW | HOLTON | KS | 66436 | 66 |
| VICTORY | HRW | HIAWATHA | KS | 66434 | 66 |
| VICTORY | HRW | CUNNINGHAM | KS | 67035 | 67 |
| VICTORY | HRW | LINCOLN | KS | 67455 | 67 |
| VICTORY | HRW | OTIS | CO | 80743 | 68 |
| VICTORY | HRW | MANHATTAN | KS | 66502 | 68 |
| VICTORY | HRW | MINNEAPOLIS | KS | 67467 | 68 |
| VICTORY | HRW | ASHERVILLE | KS | 67420 | 69 |
| VICTORY | HRW | ST-JOHN | KS | 67576 | 69 |
| VICTORY | HRW | WHITE-CLOUD | KS | 66094 | 70 |
| VICTORY | HRW | COLDWATER | KS | 67029 | 71 |
| VICTORY | HRW | JETMORE | KS | 67854 | 73 |
| VICTORY | HRW | RYUS | KS | 67870 | 74 |

TABLE 3. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|--------------------|-------|--------------|-------|---------|----------|
| VICTORY | HRW | PHILLIPSBURG | KS | 67661 | 74 |
| VICTORY | HRW | PARK | KS | 67751 | 74 |
| VICTORY | HRW | ASHERVILLE | KS | 67420 | 75 |
| VICTORY | HRW | SUBLETTE | KS | 67877 | 77 |
| VICTORY | HRW | HUGOTON | KS | 67951 | 78 |
| VICTORY | HRW | HUGOTON | KS | 67951 | 79 |
| VICTORY | HRW | PHILLIPSBURG | KS | 67661 | 83 |
| VONA | HRW | CHICKASHA | OK | 73015 | 46 |
| VONA | HRW | CHICKASHA | OK | 73015 | 50 |
| VONA | HRW | CHAPPELL | NE | 69129 | 53 |
| VONA | HRW | PEETZ | CO | 80747 | 54 |
| VONA | HRW | CHICKASHA | OK | 73015 | 55 |
| VONA | HRW | CHICKASHA | OK | 73015 | 57 |
| VONA | HRW | KANORADO | KS | 67741 | 59 |
| VONA | HRW | PEETZ | CO | 80747 | 60 |
| VONA | HRW | CHICKASHA | OK | 73015 | 60 |
| VONA | HRW | ALLIANCE | NE | 69301 | 62 |
| VONA | HRW | ALLIANCE | NE | 69301 | 63 |
| VONA | HRW | PEETZ | CO | 80747 | 63 |
| VONA | HRW | GORDON | NE | 69343 | 65 |
| VONA | HRW | LIMON | CO | 80828 | 65 |
| VONA | HRW | COLDWATER | KS | 67029 | 66 |
| VONA | HRW | OTIS | CO | 80743 | 68 |
| VONA | HRW | PEETZ | CO | 80747 | 69 |
| VONA | HRW | HEMINGFORD | NE | 69348 | 69 |
| VONA | HRW | PEETZ | CO | 80747 | 70 |
| VONA | HRW | STANTON-CO | KS | 67855 | 72 |
| WALDRON | HRS | WYNDMERE | ND | 58081 | 95 |
| WEATHERMASTER-140A | HRW | SEWARD | KS | 67577 | 68 |
| WHEATON | HRS | ARGYLE | MN | 56713 | 69 |
| WHEATON | HRS | CYRUS | MN | 56323 | 75 |
| WHEATON | HRS | ARGYLE | MN | 56713 | 76 |
| WHEATON | HRS | BEULAH | ND | 58523 | 76 |
| WHEATON | HRS | ARGYLE | MN | 56713 | 82 |
| WHEATON | HRS | ARGYLE | MN | 56713 | 87 |
| WHEATON | HRS | ARGYLE | MN | 56713 | 90 |
| WINGS | HRW | IDALIA | CO | 80735 | 45 |
| WINGS | HRW | IDALIA | CO | 80735 | 50 |
| WINGS | HRW | ANTHONY | KS | 67003 | 59 |
| WRANGLER | HRW | AFTON | OK | 74331 | 63 |
| WRANGLER | HRW | CUNNINGHAM | KS | 67035 | 65 |
| WRANGLER | HRW | AFTON | OK | 74331 | 66 |
| WRANGLER | HRW | ANTHONY | KS | 67003 | 66 |
| YECORA-ROJO | HRW | GOSHEN | CA | 93227 | 71 |
| YECORA-ROJO | HRW | GOSHEN | CA | 93227 | 71 |
| YECORA-ROJO | HRW | GOSHEN | CA | 93227 | 71 |
| YECORA-ROJO | HRW | GOSHEN | CA | 93227 | 71 |
| YECORA-ROJO | HRW | GOSHEN | CA | 93227 | 71 |
| YECORA-ROJO | HRW | GOSHEN | CA | 93227 | 72 |
| YECORA-ROJO | HRW | GOSHEN | CA | 93227 | 72 |
| YECORA-ROJO | HRW | GOSHEN | CA | 93227 | 72 |

TABLE 3. NIR HARDNESS OF COMMERCIAL SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|------------|-------|--------|-------|---------|----------|
| ECORA-ROJO | HRW | GOSHEN | CA | 93227 | 72 |
| ECORA-ROJO | HRW | GOSHEN | CA | 93227 | 72 |
| ECORA-ROJO | HRW | GOSHEN | CA | 93227 | 73 |
| ECORA-ROJO | HRW | GOSHEN | CA | 93227 | 73 |
| ECORA-ROJO | HRW | GOSHEN | CA | 93227 | 73 |
| ECORA-ROJO | HRW | GOSHEN | CA | 93227 | 74 |
| ECORA-ROJO | HRW | GOSHEN | CA | 93227 | 74 |
| ECORA-ROJO | HRW | GOSHEN | CA | 93227 | 75 |
| ECORA-ROJO | HRW | GOSHEN | CA | 93227 | 76 |
| ECORA-ROJO | HRW | GOSHEN | CA | 93227 | 76 |
| ECORA-ROJO | HRW | GOSHEN | CA | 93227 | 77 |
| ECORA-ROJO | HRW | GOSHEN | CA | 93227 | 77 |

TABLE 4. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNES |
|-------------------|-------|----------------|-------|---------|---------|
| ABILENE | HRW | WILSEY | KS | 66873 | 62 |
| ABILENE | HRW | MENTOR | KS | 67401 | 64 |
| ABILENE | HRW | NORDIN | OK | 74631 | 64 |
| ABILENE | HRW | PARTRIDGE | KS | 67566 | 66 |
| ABILENE | HRW | PALMER | KS | 66962 | 69 |
| ABILENE | HRW | MORAN | KS | 66755 | 69 |
| ABILENE | HRW | EVEREST | KS | 66424 | 70 |
| ABILENE | HRW | EVEREST | KS | 66424 | 71 |
| ABILENE | HRW | KINGMAN | KS | 67068 | 73 |
| ABILENE | HRW | GREELEY | KS | 66033 | 77 |
| ABILENE-DRYLAND | HRW | RENO-CO | KS | 67501 | 47 |
| ABILENE-DRYLAND | HRW | HARVEY-CO | KS | 67114 | 53 |
| ABILENE-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 59 |
| ABILENE-DRYLAND | HRW | STAFFORD-CO | KS | 67576 | 61 |
| ABILENE-DRYLAND | HRW | FRANKLIN-CO | KS | 66067 | 62 |
| ABILENE-DRYLAND | HRW | BROWN-CO | KS | 66434 | 63 |
| ABILENE-DRYLAND | HRW | THOMAS-CO | KS | 66701 | 63 |
| ABILENE-DRYLAND | HRW | REPUBLIC-CO | KS | 66935 | 66 |
| ABILENE-DRYLAND | HRW | ELLIS-CO | KS | 67601 | 67 |
| ABILENE-DRYLAND | HRW | LABETTE | KS | 67350 | 68 |
| ABILENE-DRYLAND | HRW | FINNEY-CO | KS | 67846 | 71 |
| ABILENE-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 72 |
| ABILENE-IRRIGATED | HRW | FINNEY-CO | KS | 67846 | 60 |
| ABILENE-IRRIGATED | HRW | STAFFORD-CO | KS | 67576 | 60 |
| ARKAN | HRW | MORAN | KS | 66755 | 45 |
| ARKAN | HRW | SABETHA | KS | 66534 | 55 |
| ARKAN | HRW | CANEY | KS | 67333 | 56 |
| ARKAN | HRW | HILLSBORO | KS | 67063 | 58 |
| ARKAN | HRW | NORDIN | OK | 74631 | 58 |
| ARKAN | HRW | PALMER | KS | 66962 | 58 |
| ARKAN | HRW | ARKANSAS-CITY | KS | 67005 | 60 |
| ARKAN | HRW | MILFORD | KS | 66514 | 61 |
| ARKAN | HRW | ALTA-VISTA | KS | 66834 | 61 |
| ARKAN | HRW | DELIA | KS | 66418 | 62 |
| ARKAN | HRW | HAVILAND | KS | 67059 | 63 |
| ARKAN | HRW | BONNER-SPRINGS | KS | 66012 | 63 |
| ARKAN | HRW | BONNER-SPRINGS | KS | 66012 | 64 |
| ARKAN | HRW | HAVEN | KS | 67543 | 65 |
| ARKAN | HRW | MANHATTAN | KS | 66502 | 65 |
| ARKAN | HRW | SYLVAN-GROVE | KS | 67481 | 65 |
| ARKAN | HRW | SYLVAN-GROVE | KS | 67481 | 65 |
| ARKAN | HRW | MILTONVALE | KS | 67466 | 66 |
| ARKAN | HRW | BELOIT | KS | 67420 | 66 |
| ARKAN | HRW | ARKANSAS-CITY | KS | 67005 | 67 |
| ARKAN | HRW | PALMER | KS | 66962 | 70 |
| ARKAN-DRYLAND | HRW | RENO-CO | KS | 67501 | 45 |
| ARKAN-DRYLAND | HRW | BROWN-CO | KS | 66434 | 50 |
| ARKAN-DRYLAND | HRW | STAFFORD-CO | KS | 67576 | 52 |
| ARKAN-DRYLAND | HRW | HARVEY-CO | KS | 67114 | 57 |
| ARKAN-DRYLAND | HRW | FRANKLIN-CO | KS | 66067 | 58 |
| ARKAN-DRYLAND | HRW | REPUBLIC-CO | KS | 66935 | 58 |

TABLE 4. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|--------------------|-------|-------------|-------|---------|----------|
| ARKAN-DRYLAND | HRW | RILEY-CO | KS | 66502 | 58 |
| ARKAN-DRYLAND | HRW | THOMAS-CO | KS | 66701 | 59 |
| ARKAN-DRYLAND | HRW | FINNEY-CO | KS | 67846 | 61 |
| ARKAN-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 61 |
| ARKAN-DRYLAND | HRW | ELLIS-CO | KS | 67601 | 65 |
| ARKAN-DRYLAND | HRW | LABETTE | KS | 67350 | 66 |
| ARKAN-IRRIGATED | HRW | STAFFORD-CO | KS | 67576 | 55 |
| ARKAN-IRRIGATED | HRW | GREELEY-CO | KS | 67879 | 59 |
| ARKAN-IRRIGATED | HRW | THOMAS-CO | KS | 66701 | 60 |
| ARKAN-IRRIGATED | HRW | FINNEY-CO | KS | 67846 | 64 |
| BECKER-DRYLAND | SRW | FRANKLIN-CO | KS | 66067 | 17 |
| BECKER-DRYLAND | SRW | LABETTE | KS | 67350 | 26 |
| BH-122 | HRW | NORDIN | OK | 74631 | 51 |
| BH-122-DRYLAND | HRW | RENO-CO | KS | 67501 | 37 |
| BH-122-DRYLAND | HRW | HARVEY-CO | KS | 67114 | 47 |
| BH-122-DRYLAND | HRW | STAFFORD-CO | KS | 67576 | 51 |
| BH-122-DRYLAND | HRW | LABETTE | KS | 67350 | 55 |
| BH-122-DRYLAND | HRW | BROWN-CO | KS | 66434 | 55 |
| BH-122-DRYLAND | HRW | FRANKLIN-CO | KS | 66067 | 59 |
| BH-122-DRYLAND | HRW | FINNEY-CO | KS | 67846 | 60 |
| BH-122-DRYLAND | HRW | REPUBLIC-CO | KS | 66935 | 61 |
| BH-122-IRRIGATED | HRW | STAFFORD-CO | KS | 67576 | 47 |
| BH-122-IRRIGATED | HRW | FINNEY-CO | KS | 67846 | 55 |
| BH-122-IRRIGATED | HRW | THOMAS-CO | KS | 66701 | 58 |
| BH-203A-DRYLAND | HRW | RENO-CO | KS | 67501 | 36 |
| BH-203A-DRYLAND | HRW | BROWN-CO | KS | 66434 | 38 |
| BH-203A-DRYLAND | HRW | STAFFORD-CO | KS | 67576 | 42 |
| BH-203A-DRYLAND | HRW | FINNEY-CO | KS | 67846 | 44 |
| BH-203A-DRYLAND | HRW | HARVEY-CO | KS | 67114 | 46 |
| BH-203A-DRYLAND | HRW | REPUBLIC-CO | KS | 66935 | 48 |
| BH-203A-DRYLAND | HRW | LABETTE | KS | 67350 | 53 |
| BH-203A-IRRIGATED | HRW | STAFFORD-CO | KS | 67576 | 42 |
| BH-203A-IRRIGATED | HRW | THOMAS-CO | KS | 66701 | 46 |
| BH-203A-IRRIGATED | HRW | FINNEY-CO | KS | 67846 | 47 |
| BH-206-DRYLAND | HRW | RENO-CO | KS | 67501 | 47 |
| BH-206-IRRIGATED | HRW | STAFFORD-CO | KS | 67576 | 62 |
| BH-301 | HRW | NORDIN | OK | 74631 | 63 |
| BRONCO-DRYLAND | HRW | STAFFORD-CO | KS | 67576 | 55 |
| BRONCO-DRYLAND | HRW | FINNEY-CO | KS | 67846 | 62 |
| BRONCO-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 63 |
| BUTTE | HRS | BERESFORD | SD | 57004 | 72 |
| BUTTE-86 | HRS | HIGHMORE | SD | 57345 | 79 |
| BUTTE-86 | HRS | SELBY | SD | 57472 | 83 |
| BUTTE-86 | HRS | BROOKINGS | SD | 57006 | 86 |
| CALDWELL | SRW | MORAN | KS | 66755 | 19 |
| CALDWELL-DRYLAND | SRW | RILEY-CO | KS | 66502 | 19 |
| CALDWELL-DRYLAND | SRW | FRANKLIN-CO | KS | 66067 | 21 |
| CALDWELL-DRYLAND | SRW | BROWN-CO | KS | 66434 | 25 |
| CALDWELL-IRRIGATED | SRW | STAFFORD-CO | KS | 67576 | 25 |
| CARSON | HRW | NORDIN | OK | 74631 | 68 |
| CARSON-DRYLAND | HRW | STAFFORD-CO | KS | 67576 | 60 |

TABLE 4. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|----------------------|-------|-------------|-------|---------|----------|
| CARSON-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 67 |
| CARSON-DRYLAND | HRW | THOMAS-CO | KS | 66701 | 67 |
| CENTURA-DRYLAND | HRW | RENO-CO | KS | 67501 | 50 |
| CENTURA-DRYLAND | HRW | BROWN-CO | KS | 66434 | 62 |
| CENTURA-DRYLAND | HRW | STAFFORD-CO | KS | 67576 | 65 |
| CENTURA-DRYLAND | HRW | REPUBLIC-CO | KS | 66935 | 69 |
| CENTURA-DRYLAND | HRW | FRANKLIN-CO | KS | 66067 | 72 |
| CENTURA-DRYLAND | HRW | RILEY-CO | KS | 66502 | 73 |
| CENTURA-DRYLAND | HRW | THOMAS-CO | KS | 66701 | 75 |
| CENTURY | HRW | CORVALLIS | OR | 97330 | 52 |
| CENTURY | HRW | OLNEY | TX | 76374 | 54 |
| CENTURY | HRW | CHILICOTHE | TX | 76384 | 56 |
| CENTURY | HRW | MORO | OR | 97039 | 58 |
| CENTURY | HRW | MUNDAY | TX | 76301 | 63 |
| CENTURY-87 | HRW | STILLWELL | OK | 74960 | 41 |
| CENTURY-87 | HRW | LAHOMA | OK | 73754 | 49 |
| CENTURY-87 | HRW | GOODWELL | OK | 73939 | 56 |
| CENTURY-87-IRRIGATED | HRW | GOODWELL | OK | 73939 | 59 |
| CENTURY-88 | HRW | ALTUS | OK | 73521 | 36 |
| CENTURY-88 | HRW | LAHOMA | OK | 73754 | 56 |
| CENTURY-88 | HRW | ALTUS | OK | 73521 | 57 |
| CENTURY-88 | HRW | GOODWELL | OK | 73939 | 57 |
| CENTURY-88 | HRW | WOODWARD | OK | 73801 | 61 |
| CENTURY-88 | HRW | STILLWELL | OK | 74960 | 66 |
| CENTURY-88-IRRIGATED | HRW | GOODWELL | OK | 73939 | 54 |
| CENTURY-DRYLAND | HRW | RENO-CO | KS | 67501 | 50 |
| CENTURY-DRYLAND | HRW | HARVEY-CO | KS | 67114 | 50 |
| CENTURY-DRYLAND | HRW | FRANKLIN-CO | KS | 66067 | 57 |
| CENTURY-DRYLAND | HRW | RILEY-CO | KS | 66502 | 60 |
| CENTURY-DRYLAND | HRW | STAFFORD-CO | KS | 67576 | 60 |
| CENTURY-DRYLAND | HRW | BROWN-CO | KS | 66434 | 61 |
| CENTURY-DRYLAND | HRW | LABETTE | KS | 67350 | 67 |
| CENTURY-DRYLAND | HRW | FINNEY-CO | KS | 67846 | 71 |
| CENTURY-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 73 |
| CENTURY-IRRIGATED | HRW | STAFFORD-CO | KS | 67576 | 55 |
| CENTURY-IRRIGATED | HRW | THOMAS-CO | KS | 66701 | 61 |
| CENTURY-IRRIGATED | HRW | FINNEY-CO | KS | 67846 | 62 |
| CHEYENNE | HRW | MORO | OR | 97039 | 62 |
| CHEYENNE | HRW | CORVALLIS | OR | 97330 | 64 |
| CHISHOLM | HRW | TOLBERT | TX | 76384 | 30 |
| CHISHOLM | HRW | OLNEY | TX | 76374 | 32 |
| CHISHOLM | HRW | MUNDAY | TX | 76301 | 33 |
| CHISHOLM | HRW | NORDIN | OK | 74631 | 46 |
| CHISHOLM-87 | HRW | LAHOMA | OK | 73754 | 23 |
| CHISHOLM-87 | HRW | STILLWELL | OK | 74960 | 28 |
| CHISHOLM-87 | HRW | WOODWARD | OK | 73801 | 29 |
| CHISHOLM-87 | HRW | GOODWELL | OK | 73939 | 39 |
| CHISHOLM-88 | HRW | ALTUS | OK | 73521 | 23 |
| CHISHOLM-88 | HRW | ALTUS | OK | 73521 | 35 |
| CHISHOLM-88 | HRW | GOODWELL | OK | 73939 | 37 |
| CHISHOLM-88 | HRW | STILLWELL | OK | 74960 | 42 |

TABLE 4. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|------------------------|-------|-------------|-------|---------|----------|
| CHISHOLM-88 | HRW | WOODWARD | OK | 73801 | 43 |
| CHISHOLM-88 | HRW | LAHOMA | OK | 73754 | 45 |
| CHISHOLM-88-IRRIGATED | HRW | GOODWELL | OK | 73939 | 38 |
| CHISHOLM-DRYLAND | HRW | RENO-CO | KS | 67501 | 27 |
| CHISHOLM-DRYLAND | HRW | STAFFORD-CO | KS | 67576 | 37 |
| CHISHOLM-DRYLAND | HRW | RILEY-CO | KS | 66502 | 38 |
| CHISHOLM-DRYLAND | HRW | REPUBLIC-CO | KS | 66935 | 38 |
| CHISHOLM-DRYLAND | HRW | HARVEY-CO | KS | 67114 | 38 |
| CHISHOLM-DRYLAND | HRW | ELLIS-CO | KS | 67601 | 42 |
| CHISHOLM-DRYLAND | HRW | BROWN-CO | KS | 66434 | 42 |
| CHISHOLM-DRYLAND | HRW | FRANKLIN-CO | KS | 66067 | 44 |
| CHISHOLM-DRYLAND | HRW | FINNEY-CO | KS | 67846 | 46 |
| CHISHOLM-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 46 |
| CHISHOLM-IRRIGATED | HRW | STAFFORD-CO | KS | 67576 | 37 |
| CHISHOLM-IRRIGATED | HRW | THOMAS-CO | KS | 66701 | 54 |
| CO820026-EXP-DRYLAND | HRW | THOMAS-CO | KS | 66701 | 60 |
| CO820026-EXP-IRRIGATED | HRW | STAFFORD-CO | KS | 67576 | 54 |
| CO820026-EXP-IRRIGATED | HRW | THOMAS-CO | KS | 66701 | 62 |
| CODY-DRYLAND | HRW | REPUBLIC-CO | KS | 66935 | 71 |
| CODY-DRYLAND | HRW | THOMAS-CO | KS | 66701 | 71 |
| CODY-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 72 |
| CODY-DRYLAND | HRW | ELLIS-CO | KS | 67601 | 77 |
| CODY-IRRIGATED | HRW | GREELEY-CO | KS | 67879 | 65 |
| CODY-IRRIGATED | HRW | THOMAS-CO | KS | 66701 | 67 |
| COLLIN | HRW | OLNEY | TX | 76374 | 22 |
| COLLIN | HRW | TOLBERT | TX | 76384 | 25 |
| COLLIN | HRW | MUNDAY | TX | 76301 | 26 |
| COLLIN | HRW | CHILICOTHE | TX | 76384 | 29 |
| COLT | HRW | CORVALLIS | OR | 97330 | 43 |
| COLT | HRW | MORO | OR | 97039 | 52 |
| COLT-DRYLAND | HRW | RILEY-CO | KS | 66502 | 50 |
| COLT-DRYLAND | HRW | BROWN-CO | KS | 66434 | 51 |
| COLT-DRYLAND | HRW | REPUBLIC-CO | KS | 66935 | 56 |
| COLT-DRYLAND | HRW | THOMAS-CO | KS | 66701 | 60 |
| COLT-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 64 |
| COLT-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 62 |
| COLT-IRRIGATED | HRW | RILEY-CO | KS | 66502 | 15 |
| COMPTON-DRYLAND | SRW | BROWN-CO | KS | 66434 | 20 |
| COMPTON-DRYLAND | SRW | FRANKLIN-CO | KS | 66067 | 22 |
| COMPTON-DRYLAND | SRW | LABETTE | KS | 67350 | 26 |
| COMPTON-DRYLAND | SRW | STAFFORD-CO | KS | 67576 | 18 |
| COMPTON-IRRIGATED | HRW | PRESHO | SD | 57568 | 49 |
| DAWN | HRW | PRESHO | SD | 57568 | 55 |
| DAWN | HRW | ONIDA | SD | 57564 | 59 |
| DAWN | HRW | BROOKINGS | SD | 57006 | 59 |
| DAWN | HRW | LABETTE | KS | 67350 | 62 |
| DELANGE-7834-DRYLAND | HRW | RENO-CO | KS | 67501 | 46 |
| DELANGE-7837-DRYLAND | HRW | STAFFORD-CO | KS | 67576 | 50 |
| DELANGE-7837-DRYLAND | HRW | BROWN-CO | KS | 66434 | 52 |
| DELANGE-7837-DRYLAND | HRW | HARVEY-CO | KS | 67114 | 53 |
| DELANGE-7837-DRYLAND | HRW | FRANKLIN-CO | KS | 66067 | 56 |

TABLE 4. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|----------------------|-------|----------------|-------|---------|----------|
| DELANGE-7837-DRYLAND | HRW | THOMAS-CO | KS | 66701 | 59 |
| DELANGE-7837-DRYLAND | HRW | ELLIS-CO | KS | 67601 | 61 |
| DELANGE-7837-DRYLAND | HRW | FINNEY-CO | KS | 67846 | 72 |
| DELANGE-7846-DRYLAND | HRW | RENO-CO | KS | 67501 | 39 |
| DELANGE-7846-DRYLAND | HRW | BROWN-CO | KS | 66434 | 50 |
| DELANGE-7846-DRYLAND | HRW | FRANKLIN-CO | KS | 66067 | 52 |
| DELANGE-7846-DRYLAND | HRW | STAFFORD-CO | KS | 67576 | 54 |
| DELANGE-7846-DRYLAND | HRW | RILEY-CO | KS | 66502 | 57 |
| DELANGE-7846-DRYLAND | HRW | THOMAS-CO | KS | 66701 | 60 |
| DELANGE-7846-DRYLAND | HRW | FINNEY-CO | KS | 67846 | 61 |
| DELANGE-7846-DRYLAND | HRW | LABETTE | KS | 67350 | 68 |
| DODGE | HRW | CORVALLIS | OR | 97330 | 48 |
| DODGE | HRW | MORO | OR | 97039 | 57 |
| DODGE | HRW | RANSOM | KS | 67572 | 67 |
| DODGE | HRW | BONNER-SPRINGS | KS | 66012 | 68 |
| DODGE | HRW | TIMKEN | KS | 67582 | 69 |
| DODGE | HRW | LARNED | KS | 67550 | 72 |
| DODGE | HRW | MANTER | KS | 67862 | 73 |
| DODGE-DRYLAND | HRW | BROWN-CO | KS | 66434 | 54 |
| DODGE-DRYLAND | HRW | FRANKLIN-CO | KS | 66067 | 56 |
| DODGE-DRYLAND | HRW | STAFFORD-CO | KS | 67576 | 59 |
| DODGE-DRYLAND | HRW | THOMAS-CO | KS | 66701 | 62 |
| DODGE-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 65 |
| DODGE-DRYLAND | HRW | REPUBLIC-CO | KS | 66935 | 68 |
| DODGE-DRYLAND | HRW | FINNEY-CO | KS | 67846 | 69 |
| DODGE-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 70 |
| DODGE-DRYLAND | HRW | ELLIS-CO | KS | 67601 | 78 |
| DODGE-IRRIGATED | HRW | STAFFORD-CO | KS | 67576 | 56 |
| DODGE-IRRIGATED | HRW | FINNEY-CO | KS | 67846 | 66 |
| DUSTY | SWW | MORO | OR | 97039 | 11 |
| DUSTY | SWW | WASCO-CO | OR | 97063 | 16 |
| DUSTY | SWW | PENDLETON | OR | 97801 | 19 |
| DUSTY | SWW | CORVALLIS | OR | 97330 | 21 |
| EAGLE | HRW | MANTER | KS | 67862 | 76 |
| GUARD | HRS | BERESFORD | SD | 57004 | 63 |
| GUARD | HRS | HIGHMORE | SD | 57345 | 65 |
| GUARD | HRS | SELBY | SD | 57472 | 68 |
| GUARD | HRS | BROOKINGS | SD | 57006 | 76 |
| HAWK | HRW | CHILICOTHE | TX | 76384 | 60 |
| HAWK | HRW | MUNDAY | TX | 76301 | 70 |
| HAWK | HRW | TOLBERT | TX | 76384 | 73 |
| HILL-81 | SWW | WASCO-CO | OR | 97063 | 20 |
| HILL-81 | SWW | HERMISTON | OR | 97838 | 22 |
| HILL-81 | SWW | CORVALLIS | OR | 97330 | 24 |
| HILL-81 | SWW | MORO | OR | 97039 | 27 |
| HILL-81 | SWW | PENDLETON | OR | 97801 | 28 |
| KARL | HRW | TOLBERT | TX | 76384 | 53 |
| KARL | HRW | OLNEY | TX | 76374 | 54 |
| KARL | HRW | NORDIN | OK | 74631 | 58 |
| KARL | HRW | MUNDAY | TX | 76301 | 62 |
| KARL | HRW | CHILICOTHE | TX | 76384 | 69 |

TABLE 4. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|-------------------------|-------|-------------|-------|---------|----------|
| KARL-DRYLAND | HRW | RENO-CO | KS | 67501 | 45 |
| KARL-DRYLAND | HRW | RILEY-CO | KS | 66502 | 55 |
| KARL-DRYLAND | HRW | BROWN-CO | KS | 66434 | 56 |
| KARL-DRYLAND | HRW | REPUBLIC-CO | KS | 66935 | 62 |
| KARL-DRYLAND | HRW | STAFFORD-CO | KS | 67576 | 62 |
| KARL-DRYLAND | HRW | LABETTE | KS | 67350 | 68 |
| KARL-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 69 |
| KARL-DRYLAND | HRW | THOMAS-CO | KS | 66701 | 70 |
| KARL-DRYLAND | HRW | FINNEY-CO | KS | 67846 | 73 |
| KARL-IRRIGATED | HRW | STAFFORD-CO | KS | 67576 | 55 |
| KARL-IRRIGATED | HRW | FINNEY-CO | KS | 67846 | 63 |
| KARL-IRRIGATED | HRW | THOMAS-CO | KS | 66701 | 63 |
| KARL-IRRIGATED | HRW | GREELEY-CO | KS | 67879 | 67 |
| KS-4578 | HRW | CORVALLIS | OR | 97330 | 68 |
| KS-831862 | HW | CORVALLIS | OR | 97330 | 65 |
| KS-831862 | HW | MORO | OR | 97039 | 70 |
| KS84HW196-EXP-DRYLAND | HW | RENO-CO | KS | 67501 | 44 |
| KS84HW196-EXP-DRYLAND | HW | STAFFORD-CO | KS | 67576 | 56 |
| KS84HW196-EXP-DRYLAND | HW | FINNEY-CO | KS | 67846 | 62 |
| KS84HW196-EXP-DRYLAND | HW | ELLIS-CO | KS | 67601 | 63 |
| KS84HW196-EXP-IRRIGATED | HW | FINNEY-CO | KS | 67846 | 68 |
| KS84W196-EXP-DRYLAND | HW | THOMAS-CO | KS | 66701 | 70 |
| KS84WH196-EXP-IRRIGATED | HW | THOMAS-CO | KS | 66701 | 67 |
| LARNED | HRW | PENOKEE | KS | 67642 | 63 |
| LARNED | HRW | PENOKEE | KS | 67642 | 66 |
| LARNED | HRW | RANSOM | KS | 67572 | 67 |
| LARNED | HRW | CIMMERON | KS | 67835 | 69 |
| LARNED | HRW | MENLO | KS | 67746 | 71 |
| LARNED | HRW | WAKENEY | KS | 67672 | 71 |
| LARNED | HRW | LARNED | KS | 67550 | 76 |
| LARNED-DRYLAND | HRW | RENO-CO | KS | 67501 | 45 |
| LARNED-DRYLAND | HRW | HARVEY-CO | KS | 67114 | 57 |
| LARNED-DRYLAND | HRW | BROWN-CO | KS | 66434 | 61 |
| LARNED-DRYLAND | HRW | STAFFORD-CO | KS | 67576 | 63 |
| LARNED-DRYLAND | HRW | RILEY-CO | KS | 66502 | 64 |
| LARNED-DRYLAND | HRW | THOMAS-CO | KS | 66701 | 65 |
| LARNED-DRYLAND | HRW | FINNEY-CO | KS | 67846 | 67 |
| LARNED-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 67 |
| LARNED-DRYLAND | HRW | FRANKLIN-CO | KS | 66067 | 68 |
| LARNED-DRYLAND | HRW | LABETTE | KS | 67350 | 73 |
| LEN | HRS | BERESFORD | SD | 57004 | 71 |
| LEN | HRS | CROOKSTON | MN | 56716 | 72 |
| LEN | HRS | ST-PAUL | MN | 55101 | 81 |
| LEN | HRS | MORRIS | MN | 56267 | 81 |
| LEN | HRS | HIGHMORE | SD | 57345 | 82 |
| LEN | HRS | BROOKINGS | SD | 57006 | 87 |
| MALCOLM | SWW | WASCO-CO | OR | 97063 | 20 |
| MALCOLM | SWW | CORVALLIS | OR | 97330 | 27 |
| MALCOLM | SWW | MORO | OR | 97039 | 31 |
| MARSHALL | HRS | BERESFORD | SD | 57004 | 65 |
| MARSHALL | HRS | CROOKSTON | MN | 56716 | 66 |

TABLE 4. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|----------------------|-------|--------------|-------|---------|----------|
| MARSHALL | HRS | MORRIS | MN | 56267 | 69 |
| MARSHALL | HRS | SELBY | SD | 57472 | 71 |
| MARSHALL | HRS | HIGHMORE | SD | 57345 | 74 |
| MARSHALL | HRS | ST-PAUL | MN | 55101 | 76 |
| MARSHALL | HRS | BROOKINGS | SD | 57006 | 77 |
| MESA | HRW | OLNEY | TX | 76374 | 58 |
| MESA | HRW | MORAN | KS | 66755 | 59 |
| MESA | HRW | BELLE-PLAINE | KS | 67013 | 59 |
| MESA | HRW | MUNDAY | TX | 76301 | 62 |
| MESA | HRW | BELLE-PLAINE | KS | 67013 | 62 |
| MESA | HRW | GIRARD | KS | 66743 | 64 |
| MESA | HRW | TOLBERT | TX | 76384 | 64 |
| MESA | HRW | WINFIELD | KS | 67156 | 64 |
| MESA | HRW | WINFIELD | KS | 67156 | 66 |
| MESA | HRW | ULYSSES | KS | 67880 | 68 |
| MESA | HRW | CHASE | KS | 67524 | 69 |
| MESA | HRW | PARTRIDGE | KS | 67566 | 72 |
| MESA | HRW | CHILICOTHE | TX | 76384 | 72 |
| MESA | HRW | MANHATTAN | KS | 66502 | 73 |
| MESA | HRW | GARDEN-CITY | KS | 67846 | 75 |
| MESA | HRW | GARDEN-CITY | KS | 67846 | 75 |
| MESA | HRW | PALMER | KS | 66962 | 76 |
| MESA | HRW | BISON | KS | 67520 | 76 |
| MESA-DRYLAND | HRW | RENO-CO | KS | 67501 | 53 |
| MESA-DRYLAND | HRW | BROWN-CO | KS | 66434 | 58 |
| MESA-DRYLAND | HRW | HARVEY-CO | KS | 67114 | 59 |
| MESA-DRYLAND | HRW | THOMAS-CO | KS | 66701 | 60 |
| MESA-DRYLAND | HRW | FRANKLIN-CO | KS | 66067 | 60 |
| MESA-DRYLAND | HRW | RILEY-CO | KS | 66502 | 62 |
| MESA-DRYLAND | HRW | REPUBLIC-CO | KS | 66935 | 64 |
| MESA-DRYLAND | HRW | STAFFORD-CO | KS | 67576 | 68 |
| MESA-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 71 |
| MESA-DRYLAND | HRW | LABETTE | KS | 67350 | 72 |
| MESA-DRYLAND | HRW | ELLIS-CO | KS | 67601 | 75 |
| MESA-IRRIGATED | HRW | THOMAS-CO | KS | 66701 | 60 |
| MESA-IRRIGATED | HRW | GREELEY-CO | KS | 67879 | 63 |
| MESA-IRRIGATED | HRW | STAFFORD-CO | KS | 67576 | 64 |
| MESA-65-EXP-DRYLAND | SRW | RILEY-CO | KS | 66502 | 8 |
| MESA-65-EXP-DRYLAND | SRW | LABETTE | KS | 67350 | 14 |
| MESA-65-EXP-DRYLAND | SRW | FRANKLIN-CO | KS | 66067 | 15 |
| MESA-65-EXP-DRYLAND | SRW | BROWN-CO | KS | 66434 | 15 |
| MESA-65-EXP-DRYLAND | HRW | TOLBERT | TX | 76384 | 52 |
| MESA-65-EXP-DRYLAND | HRW | CHILICOTHE | TX | 76384 | 59 |
| MESA-65-EXP-DRYLAND | HRW | NORDIN | OK | 74631 | 63 |
| MESA-65-EXP-DRYLAND | HRW | MUNDAY | TX | 76301 | 63 |
| MUSTANG-87 | HRW | WOODWARD | OK | 73801 | 46 |
| MUSTANG-87 | HRW | LAHOMA | OK | 73754 | 46 |
| MUSTANG-87 | HRW | GOODWELL | OK | 73939 | 64 |
| MUSTANG-87-IRRIGATED | HRW | GOODWELL | OK | 73939 | 51 |
| MUSTANG-88 | HRW | ALTUS | OK | 73521 | 39 |
| MUSTANG-DRYLAND | HRW | RENO-CO | KS | 67501 | 44 |

TABLE 4. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|-------------------|-------|----------------|-------|---------|----------|
| MUSTANG-DRYLAND | HRW | HARVEY-CO | KS | 67114 | 53 |
| MUSTANG-DRYLAND | HRW | BROWN-CO | KS | 66434 | 55 |
| MUSTANG-DRYLAND | HRW | REPUBLIC-CO | KS | 66935 | 59 |
| MUSTANG-DRYLAND | HRW | RILEY-CO | KS | 66502 | 60 |
| MUSTANG-DRYLAND | HRW | FINNEY-CO | KS | 67846 | 62 |
| MUSTANG-DRYLAND | HRW | THOMAS-CO | KS | 66701 | 63 |
| MUSTANG-DRYLAND | HRW | LABETTE | KS | 67350 | 66 |
| MUSTANG-DRYLAND | HRW | ELLIS-CO | KS | 67601 | 69 |
| MUSTANG-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 71 |
| MUSTANG-IRRIGATED | HRW | GREELEY-CO | KS | 67879 | 61 |
| MUSTANG-IRRIGATED | HRW | FINNEY-CO | KS | 67846 | 62 |
| NEWTON | HRW | MANHATTAN | KS | 66502 | 53 |
| NEWTON | HRW | BONNER-SPRINGS | KS | 66012 | 58 |
| NEWTON | HRW | TIMKEN | KS | 67582 | 59 |
| NEWTON | HRW | BONNER-SPRINGS | KS | 66012 | 60 |
| NEWTON | HRW | OSBORN | KS | 67473 | 61 |
| NEWTON | HRW | LANGDON | KS | 67549 | 61 |
| NEWTON | HRW | MANTER | KS | 67862 | 70 |
| NEWTON | HRW | CIMMERON | KS | 67835 | 70 |
| NEWTON-DRYLAND | HRW | RENO-CO | KS | 67501 | 41 |
| NEWTON-DRYLAND | HRW | HARVEY-CO | KS | 67114 | 53 |
| NEWTON-DRYLAND | HRW | FRANKLIN-CO | KS | 66067 | 53 |
| NEWTON-DRYLAND | HRW | BROWN-CO | KS | 66434 | 53 |
| NEWTON-DRYLAND | HRW | RILEY-CO | KS | 66502 | 56 |
| NEWTON-DRYLAND | HRW | REPUBLIC-CO | KS | 66935 | 57 |
| NEWTON-DRYLAND | HRW | STAFFORD-CO | KS | 67576 | 58 |
| NEWTON-DRYLAND | HRW | THOMAS-CO | KS | 66701 | 58 |
| NEWTON-DRYLAND | HRW | FINNEY-CO | KS | 67846 | 63 |
| NEWTON-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 63 |
| NEWTON-DRYLAND | HRW | ELLIS-CO | KS | 67601 | 63 |
| NEWTON-DRYLAND | HRW | LABETTE | KS | 67350 | 66 |
| NEWTON-DRYLAND | HRW | STAFFORD-CO | KS | 67576 | 49 |
| NEWTON-IRRIGATED | HRW | GREELEY-CO | KS | 67879 | 52 |
| NEWTON-IRRIGATED | HRW | FINNEY-CO | KS | 67846 | 54 |
| NEWTON-IRRIGATED | HRW | OLNEY | TX | 76374 | 63 |
| NK-PRO-812 | HRW | MUNDAY | TX | 76301 | 74 |
| NK-PRO-812 | HRW | CHILICOTHE | TX | 76384 | 74 |
| NK-PRO-812 | HRW | MANHATTAN | KS | 66502 | 54 |
| NORKAN | HRW | FRANKLIN-CO | KS | 66067 | 56 |
| NORKAN | HRW | CORVALLIS | OR | 97330 | 60 |
| NORKAN | HRW | SABETHA | KS | 66534 | 63 |
| NORKAN | HRW | ALTA-VISTA | KS | 66834 | 64 |
| NORKAN | HRW | BURLINGAME | KS | 66413 | 64 |
| NORKAN | HRW | BELOIT | KS | 67420 | 65 |
| NORKAN | HRW | NORDIN | OK | 74631 | 65 |
| NORKAN | HRW | HOPE | KS | 67451 | 66 |
| NORKAN | HRW | MORO | OR | 97039 | 67 |
| NORKAN | HRW | JEWELL | KS | 66949 | 71 |
| NORKAN | HRW | MILTONVALE | KS | 67466 | 73 |
| NORKAN | HRW | RENO-CO | KS | 67501 | 41 |
| NORKAN-DRYLAND | HRW | BROWN-CO | KS | 66434 | 56 |
| NORKAN-DRYLAND | HRW | | | | |

TABLE 4. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|------------------|-------|-------------|-------|---------|----------|
| NORKAN-DRYLAND | HRW | RILEY-CO | KS | 66502 | 59 |
| NORKAN-DRYLAND | HRW | HARVEY-CO | KS | 67114 | 59 |
| NORKAN-DRYLAND | HRW | REPUBLIC-CO | KS | 66935 | 60 |
| NORKAN-DRYLAND | HRW | FINNEY-CO | KS | 67846 | 64 |
| NORKAN-DRYLAND | HRW | THOMAS-CO | KS | 66701 | 65 |
| NORKAN-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 66 |
| NORKAN-DRYLAND | HRW | LABETTE | KS | 67350 | 68 |
| NORKAN-DRYLAND | HRW | ELLIS-CO | KS | 67601 | 68 |
| NORKAN-IRRIGATED | HRW | STAFFORD-CO | KS | 67576 | 59 |
| NORKAN-IRRIGATED | HRW | FINNEY-CO | KS | 67846 | 61 |
| NORKAN-IRRIGATED | HRW | GREELEY-CO | KS | 67879 | 65 |
| OR-CR8313 | HRW | MORO | OR | 97039 | 61 |
| OR-CR8313 | HRW | CORVALLIS | OR | 97330 | 62 |
| OR-CR8313 | HRW | WASCO-CO | OR | 97063 | 63 |
| OR-CR8313 | HRW | PENDLETON | OR | 97801 | 68 |
| OR8400464P | SWW | CORVALLIS | OR | 97330 | 20 |
| OR8400464P | SWW | MORO | OR | 97039 | 28 |
| OR8400882H | SWW | PENDLETON | OR | 97801 | 24 |
| OR8400882H | SWW | MORO | OR | 97039 | 27 |
| OR8400882H | SWW | CORVALLIS | OR | 97330 | 27 |
| OR8500305P | SWW | CORVALLIS | OR | 97330 | 20 |
| OR8500305P | SWW | PENDLETON | OR | 97801 | 28 |
| OR8500374H | HWW | PENDLETON | OR | 97801 | 59 |
| OR8500374H | HWW | MORO | OR | 97039 | 64 |
| OR8500378H | HWW | CORVALLIS | OR | 97330 | 54 |
| OR8500378H | HWW | MORO | OR | 97039 | 62 |
| OR8500378H | HWW | PENDLETON | OR | 97801 | 63 |
| OR8500974P | SWW | MORO | OR | 97039 | 27 |
| OR8500974P | SWW | PENDLETON | OR | 97801 | 27 |
| OR8500974P | SWW | CORVALLIS | OR | 97330 | 33 |
| OR8502288H | SWW | CORVALLIS | OR | 97330 | 18 |
| OR8502288H | SWW | MORO | OR | 97039 | 25 |
| OR8502288H | SWW | PENDLETON | OR | 97801 | 25 |
| OR8505311P | SWW | CORVALLIS | OR | 97330 | 23 |
| OR8505311P | SWW | MORO | OR | 97039 | 42 |
| OR8505311P | SWW | PENDLETON | OR | 97801 | 48 |
| OR8600049 | HWW | CORVALLIS | OR | 97330 | 64 |
| OR8600049 | HWW | MORO | OR | 97039 | 66 |
| OR8600049 | HWW | PENDLETON | OR | 97801 | 72 |
| OR8600341 | HWW | MORO | OR | 97039 | 63 |
| OR8600341 | HWW | CORVALLIS | OR | 97330 | 65 |
| OR8600341 | HWW | PENDLETON | OR | 97801 | 68 |
| OR8600471 | HWW | MORO | OR | 97039 | 48 |
| OR8600471 | HWW | CORVALLIS | OR | 97330 | 54 |
| OR8600701 | HWW | CORVALLIS | OR | 97330 | 66 |
| OR8600701 | HWW | PENDLETON | OR | 97801 | 68 |
| OR8600701 | HWW | MORO | OR | 97039 | 73 |
| OR860292 | SWW | CORVALLIS | OR | 97330 | 21 |
| OR860292 | SWW | PENDLETON | OR | 97801 | 26 |
| OR860293 | SWW | PENDLETON | OR | 97801 | 22 |
| OR860293 | SWW | CORVALLIS | OR | 97330 | 23 |

TABLE 4. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|----------------------|-------|-------------|-------|---------|----------------|
| OR860293 | SWW | MORO | OR | 97039 | 25 |
| OR860296 | SWW | PENDLETON | OR | 97801 | 30 |
| OR860296 | SWW | CORVALLIS | OR | 97330 | 32 |
| OR860296 | SWW | MORO | OR | 97039 | 32 |
| OR860297 | HWW | MORO | OR | 97039 | 25 |
| OR860297 | HWW | CORVALLIS | OR | 97330 | 31 |
| OR860301 | SWW | PENDLETON | OR | 97801 | 22 |
| OR860301 | SWW | MORO | OR | 97039 | 22 |
| OR860301 | SWW | CORVALLIS | OR | 97330 | 23 |
| OR860302 | SWW | PENDLETON | OR | 97801 | 21 |
| OR860302 | SWW | CORVALLIS | OR | 97330 | 24 |
| OR860302 | SWW | MORO | OR | 97039 | 28 |
| OR860303 | SWW | CORVALLIS | OR | 97330 | 20 |
| OR860303 | SWW | PENDLETON | OR | 97801 | 21 |
| OR860303 | SWW | MORO | OR | 97039 | 27 |
| OR860436 | SWW | MORO | OR | 97039 | 20 |
| OR860436 | SWW | PENDLETON | OR | 97801 | 23 |
| OR860553 | SWW | PENDLETON | OR | 97801 | 25 |
| OR860553 | SWW | MORO | OR | 97039 | 29 |
| OR860553 | SWW | CORVALLIS | OR | 97330 | 31 |
| OR860553 | SWW | PENDLETON | OR | 97801 | 18 |
| OR860571 | SWW | CORVALLIS | OR | 97330 | 20 |
| OR860571 | SWW | MORO | OR | 97039 | 28 |
| OR860571 | SWW | CORVALLIS | OR | 97330 | 17 |
| OR860575 | SWW | PENDLETON | OR | 97801 | 25 |
| OR860575 | SWW | CORVALLIS | OR | 97330 | 30 |
| OR860576 | SWW | MORO | OR | 97039 | 31 |
| OR860576 | SWW | CORVALLIS | OR | 97330 | 32 |
| OR860576 | SWW | MORO | OR | 97039 | 24 |
| OR860754 | SWW | PENDLETON | OR | 97801 | 32 |
| OR860754 | SWW | CORVALLIS | OR | 97330 | 34 |
| OR860754 | HWW | MORO | OR | 97039 | 39 |
| OR860756 | HWW | CORVALLIS | OR | 97330 | 50 |
| OR860756 | HWW | PENDLETON | OR | 97801 | 53 |
| OR860756 | SWW | MORO | OR | 97039 | 27 |
| OR861219 | SWW | PENDLETON | OR | 97801 | 30 |
| OR861219 | SWW | PENDLETON | OR | 97801 | 27 |
| OR861226 | SWW | MORO | OR | 97039 | 28 |
| OR861226 | SWW | CORVALLIS | OR | 97330 | 30 |
| OR861226 | SWW | MORO | OR | 97039 | 27 |
| OR861425 | SWW | CORVALLIS | OR | 97330 | 2 ^a |
| OR861425 | SWW | PENDLETON | OR | 97801 | |
| OR861425 | SWW | CORVALLIS | OR | 97330 | |
| OVESON | SWW | MORO | OR | 97039 | |
| OVESON | SWW | WASCO-CO | OR | 97063 | |
| OVESON | SWW | HERMISTON | OR | 97838 | |
| OVESON | SWW | PENDLETON | OR | 97801 | |
| OVESON | HRW | FRANKLIN-CO | KS | 66067 | |
| PIONEER-2154 | HRW | NORDIN | OK | 74631 | |
| PIONEER-2154 | HRW | GREELEY-CO | KS | 67879 | |
| PIONEER-2154-DRYLAND | HRW | BROWN-CO | KS | 66434 | |
| PIONEER-2154-DRYLAND | | | | | |

TABLE 4. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|---------------------------|-------|-------------|-------|---------|----------|
| PIONEER-2154-DRYLAND | HRW | HARVEY-CO | KS | 67114 | 73 |
| PIONEER-2154-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 74 |
| PIONEER-2154-DRYLAND | HRW | STAFFORD-CO | KS | 67576 | 75 |
| PIONEER-2154-DRYLAND | HRW | REPUBLIC-CO | KS | 66935 | 75 |
| PIONEER-2154-DRYLAND | HRW | FINNEY-CO | KS | 67846 | 77 |
| PIONEER-2154-DRYLAND | HRW | RILEY-CO | KS | 66502 | 80 |
| PIONEER-2154-DRYLAND | HRW | ELLIS-CO | KS | 67601 | 81 |
| PIONEER-2154-DRYLAND | HRW | LABETTE | KS | 67350 | 84 |
| PIONEER-2154-IRRIGATED | HRW | THOMAS-CO | KS | 66701 | 76 |
| PIONEER-2154-IRRIGATED | HRW | STAFFORD-CO | KS | 67576 | 77 |
| PIONEER-2157 | HRW | NORDIN | OK | 74631 | 61 |
| PIONEER-2157-88 | HRW | GOODWELL | OK | 73939 | 49 |
| PIONEER-2157-88 | HRW | WOODWARD | OK | 73801 | 52 |
| PIONEER-2157-88 | HRW | LAHOMA | OK | 73754 | 56 |
| PIONEER-2157-88 | HRW | STILLWELL | OK | 74960 | 59 |
| PIONEER-2157-88 | HRW | ALTUS | OK | 73521 | 60 |
| PIONEER-2157-88-IRRIGATED | HRW | GOODWELL | OK | 73939 | 54 |
| PIONEER-2157-DRYLAND | HRW | RENO-CO | KS | 67501 | 41 |
| PIONEER-2157-DRYLAND | HRW | HARVEY-CO | KS | 67114 | 50 |
| PIONEER-2157-DRYLAND | HRW | RILEY-CO | KS | 66502 | 50 |
| PIONEER-2157-DRYLAND | HRW | STAFFORD-CO | KS | 67576 | 52 |
| PIONEER-2157-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 57 |
| PIONEER-2157-DRYLAND | HRW | ELLIS-CO | KS | 67601 | 59 |
| PIONEER-2157-DRYLAND | HRW | REPUBLIC-CO | KS | 66935 | 60 |
| PIONEER-2157-DRYLAND | HRW | BROWN-CO | KS | 66434 | 62 |
| PIONEER-2157-DRYLAND | HRW | LABETTE | KS | 67350 | 66 |
| PIONEER-2157-IRRIGATED | HRW | STAFFORD-CO | KS | 67576 | 53 |
| PIONEER-2157-IRRIGATED | HRW | GREELEY-CO | KS | 67879 | 53 |
| PIONEER-2157-IRRIGATED | HRW | FINNEY-CO | KS | 67846 | 58 |
| PIONEER-2163 | HRW | NORDIN | OK | 74631 | 62 |
| PIONEER-2172 | HRW | NORDIN | OK | 74631 | 74 |
| PIONEER-2172-DRYLAND | HRW | RENO-CO | KS | 67501 | 51 |
| PIONEER-2172-DRYLAND | HRW | RILEY-CO | KS | 66502 | 60 |
| PIONEER-2172-DRYLAND | HRW | STAFFORD-CO | KS | 67576 | 68 |
| PIONEER-2172-DRYLAND | HRW | THOMAS-CO | KS | 66701 | 71 |
| PIONEER-2172-DRYLAND | HRW | BROWN-CO | KS | 66434 | 72 |
| PIONEER-2172-DRYLAND | HRW | HARVEY-CO | KS | 67114 | 72 |
| PIONEER-2172-DRYLAND | HRW | REPUBLIC-CO | KS | 66935 | 73 |
| PIONEER-2172-DRYLAND | HRW | FINNEY-CO | KS | 67846 | 74 |
| PIONEER-2172-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 76 |
| PIONEER-2172-DRYLAND | HRW | ELLIS-CO | KS | 67601 | 79 |
| PIONEER-2172-DRYLAND | HRW | LABETTE | KS | 67350 | 84 |
| PIONEER-2172-IRRIGATED | HRW | GREELEY-CO | KS | 67879 | 71 |
| PIONEER-2172-IRRIGATED | HRW | FINNEY-CO | KS | 67846 | 75 |
| PIONEER-2172-IRRIGATED | HRW | THOMAS-CO | KS | 66701 | 76 |
| PIONEER-2306 | HRS | MORRIS | MN | 56267 | 78 |
| PIONEER-2360 | HRS | CROOKSTON | MN | 56716 | 78 |
| PIONEER-2360 | HRS | ST-PAUL | MN | 55101 | 84 |
| PIONEER-2364 | HRS | SELBY | SD | 57472 | 79 |
| PIONEER-2369 | HRS | BERESFORD | SD | 57004 | 72 |
| PIONEER-2369 | HRS | HIGHMORE | SD | 57345 | 77 |

TABLE 4. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|-----------------------|-------|-------------|-------|---------|----------|
| PIONEER-2551 | SRW | MORO | OR | 97039 | 22 |
| PIONEER-2551 | SRW | FRANKLIN-CO | KS | 66067 | 23 |
| PIONEER-2551 | SRW | CORVALLIS | OR | 97330 | 24 |
| PIONEER-2551-DRYLAND | SRW | BROWN-CO | KS | 66434 | 16 |
| PIONEER-2551-DRYLAND | SRW | RILEY-CO | KS | 66502 | 19 |
| PIONEER-2551-DRYLAND | SRW | LABETTE | KS | 67350 | 22 |
| QUANTUM-378 | HRW | NORDIN | OK | 74631 | 57 |
| QUANTUM-562-DRYLAND | HRW | THOMAS-CO | KS | 66701 | 59 |
| QUANTUM-562-DRYLAND | HRW | REPUBLIC-CO | KS | 66935 | 61 |
| QUANTUM-562-DRYLAND | HRW | ELLIS-CO | KS | 67601 | 63 |
| QUANTUM-564 | HRW | NORDIN | OK | 74631 | 54 |
| QUANTUM-578-DRYLAND | HRW | FINNEY-CO | KS | 67846 | 64 |
| QUANTUM-578-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 77 |
| QUANTUM-578-IRRIGATED | HRW | GREELEY-CO | KS | 67879 | 55 |
| QUANTUM-578-IRRIGATED | HRW | FINNEY-CO | KS | 67846 | 57 |
| QUANTUM-578-IRRIGATED | HRW | THOMAS-CO | KS | 66701 | 63 |
| REDLAND | HRW | PRESHO | SD | 57568 | 50 |
| REDLAND | HRW | ONIDA | SD | 57564 | 51 |
| REDLAND | HRW | HIGHMORE | SD | 57345 | 52 |
| REDLAND | HRW | BROOKINGS | SD | 57006 | 59 |
| REDLAND-DRYLAND | HRW | THOMAS-CO | KS | 66701 | 57 |
| REDLAND-DRYLAND | HRW | BROWN-CO | KS | 66434 | 62 |
| REDLAND-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 63 |
| REDLAND-DRYLAND | HRW | FINNEY-CO | KS | 67846 | 64 |
| REDLAND-DRYLAND | HRW | REPUBLIC-CO | KS | 66935 | 65 |
| RH-7833 | HRW | NORDIN | OK | 74631 | 57 |
| RH-7837 | HRW | NORDIN | OK | 74631 | 55 |
| RH7837 | HRW | HOPE | KS | 67451 | 61 |
| RH7846 | HRW | HOPE | KS | 67451 | 57 |
| RH7846 | HRW | PALMER | KS | 66962 | 61 |
| RIO-BLANCO | HWW | NORDIN | OK | 74631 | 58 |
| RIO-BLANCO-DRYLAND | HWW | RENO-CO | KS | 67501 | 41 |
| RIO-BLANCO-DRYLAND | HWW | HARVEY-CO | KS | 67114 | 51 |
| RIO-BLANCO-DRYLAND | HWW | RILEY-CO | KS | 66502 | 56 |
| RIO-BLANCO-DRYLAND | HWW | BROWN-CO | KS | 66434 | 58 |
| RIO-BLANCO-DRYLAND | HWW | FRANKLIN-CO | KS | 66067 | 61 |
| RIO-BLANCO-DRYLAND | HWW | STAFFORD-CO | KS | 67576 | 61 |
| RIO-BLANCO-DRYLAND | HWW | THOMAS-CO | KS | 66701 | 61 |
| RIO-BLANCO-DRYLAND | HWW | FINNEY-CO | KS | 67846 | 62 |
| RIO-BLANCO-DRYLAND | HWW | ELLIS-CO | KS | 67601 | 63 |
| RIO-BLANCO-DRYLAND | HWW | LABETTE | KS | 67350 | 66 |
| RIO-BLANCO-DRYLAND | HWW | STAFFORD-CO | KS | 67576 | 58 |
| RIO-BLANCO-IRRIGATED | HWW | THOMAS-CO | KS | 66701 | 58 |
| RIO-BLANCO-IRRIGATED | HWW | GREELEY-CO | KS | 67879 | 59 |
| RIO-BLANCO-IRRIGATED | HWW | FINNEY-CO | KS | 67846 | 59 |
| RIO-BLANCO-IRRIGATED | HRW | PRESHO | SD | 57568 | 57 |
| ROSE | HRW | ONIDA | SD | 57564 | 59 |
| ROSE | HRW | HIGHMORE | SD | 57345 | 61 |
| ROSE | HRW | BROOKINGS | SD | 57006 | 66 |
| ROSE | HRW | PRESHO | SD | 57568 | 58 |
| ROUGH RIDER | HRW | HIGHMORE | SD | 57345 | 62 |

TABLE 4. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|------------------------|-------|-------------|-------|---------|----------|
| ROUGH RIDER | HRW | ONIDA | SD | 57564 | 63 |
| ROUGH RIDER | HRW | BROOKINGS | SD | 57006 | 67 |
| SANDY-DRYLAND | HRW | STAFFORD-CO | KS | 67576 | 68 |
| SANDY-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 74 |
| SCOUT-66 | HRW | HIGHMORE | SD | 57345 | 62 |
| SCOUT-66 | HRW | FRANKLIN-CO | KS | 66067 | 63 |
| SCOUT-66 | HRW | OLNEY | TX | 76374 | 63 |
| SCOUT-66 | HRW | BROOKINGS | SD | 57006 | 64 |
| SCOUT-66 | HRW | CHILICOTHE | TX | 76384 | 65 |
| SCOUT-66 | HRW | MUNDAY | TX | 76301 | 66 |
| SCOUT-66 | HRW | ONIDA | SD | 57564 | 67 |
| SCOUT-66 | HRW | TOLBERT | TX | 76384 | 67 |
| SCOUT-66 | HRW | SUBLETTE | KS | 67877 | 76 |
| SCOUT-66-DRYLAND | HRW | BROWN-CO | KS | 66434 | 60 |
| SCOUT-66-DRYLAND | HRW | STAFFORD-CO | KS | 67576 | 63 |
| SCOUT-66-DRYLAND | HRW | RILEY-CO | KS | 66502 | 64 |
| SCOUT-66-DRYLAND | HRW | REPUBLIC-CO | KS | 66935 | 64 |
| SCOUT-66-DRYLAND | HRW | HARVEY-CO | KS | 67114 | 66 |
| SCOUT-66-DRYLAND | HRW | THOMAS-CO | KS | 66701 | 68 |
| SCOUT-66-DRYLAND | HRW | FINNEY-CO | KS | 67846 | 69 |
| SCOUT-66-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 71 |
| SCOUT-66-DRYLAND | HRW | LABETTE | KS | 67350 | 74 |
| SIOUXLAND | HRW | ONIDA | SD | 57564 | 54 |
| SIOUXLAND | HRW | HIGHMORE | SD | 57345 | 58 |
| SIOUXLAND | HRW | OLNEY | TX | 76374 | 59 |
| SIOUXLAND | HRW | GREELEY | KS | 66033 | 59 |
| SIOUXLAND | HRW | BROOKINGS | SD | 57006 | 59 |
| SIOUXLAND | HRW | BURLINGAME | KS | 66413 | 60 |
| SIOUXLAND | HRW | FRANKLIN-CO | KS | 66067 | 60 |
| SIOUXLAND | HRW | CHILICOTHE | TX | 76384 | 62 |
| SIOUXLAND | HRW | TOLBERT | TX | 76384 | 62 |
| SIOUXLAND | HRW | MUNDAY | TX | 76301 | 67 |
| SIOUXLAND | HRW | LYONS | KS | 67554 | 68 |
| SIOUXLAND-87 | HRW | STILLWELL | OK | 74960 | 50 |
| SIOUXLAND-87 | HRW | WOODWARD | OK | 73801 | 50 |
| SIOUXLAND-87 | HRW | LAHOMA | OK | 73754 | 50 |
| SIOUXLAND-87 | HRW | GOODWELL | OK | 73939 | 62 |
| SIOUXLAND-87-IRRIGATED | HRW | GOODWELL | OK | 73939 | 59 |
| | HRW | WOODWARD | OK | 73801 | 61 |
| | HRW | GOODWELL | OK | 73939 | 62 |
| | HRW | STILLWELL | OK | 74960 | 69 |
| | HRW | ALTUS | OK | 73521 | 72 |
| | HRW | GOODWELL | OK | 73939 | 60 |
| | HRW | RENO-CO | KS | 67501 | 39 |
| | HRW | STAFFORD-CO | KS | 67576 | 59 |
| | HRW | BROWN-CO | KS | 66434 | 61 |
| | HRW | HARVEY-CO | KS | 67114 | 61 |
| | HRW | RILEY-CO | KS | 66502 | 62 |
| | HRW | ELLIS-CO | KS | 67601 | 69 |
| | HRW | LABETTE | KS | 67350 | 70 |
| | HRW | GREELEY-CO | KS | 67879 | 71 |

TABLE 4. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|-------------------------|-------|-------------|-------|---------|----------|
| SIOUXLAND-DRYLAND | HRW | FINNEY-CO | KS | 67846 | 73 |
| SIOUXLAND-IRRIGATED | HRW | GREELEY-CO | KS | 67879 | 60 |
| SIOUXLAND-IRRIGATED | HRW | STAFFORD-CO | KS | 67576 | 61 |
| SIOUXLAND-IRRIGATED | HRW | FINNEY-CO | KS | 67846 | 62 |
| SIOUXLAND-IRRIGATED | HRW | THOMAS-CO | KS | 66701 | 65 |
| STALLION | HRW | NORDIN | OK | 74631 | 64 |
| STALLION-DRYLAND | HRW | RENO-CO | KS | 67501 | 40 |
| STALLION-DRYLAND | HRW | RENO-CO | KS | 67501 | 48 |
| STALLION-DRYLAND | HRW | HARVEY-CO | KS | 67114 | 54 |
| STALLION-DRYLAND | HRW | STAFFORD-CO | KS | 67576 | 60 |
| STALLION-IRRIGATED | HRW | STAFFORD-CO | KS | 67576 | 60 |
| STALLION-IRRIGATED | HRW | FINNEY-CO | KS | 67846 | 61 |
| STALLION-IRRIGATED | HRW | GREELEY-CO | KS | 67879 | 63 |
| STAR-SEED-830-DRYLAND | HRW | REPUBLIC-CO | KS | 66935 | 64 |
| STAR-SEED-830-DRYLAND | HRW | BROWN-CO | KS | 66434 | 65 |
| STAR-SEED-830-DRYLAND | HRW | RILEY-CO | KS | 66502 | 67 |
| STAR-SEED-830-DRYLAND | HRW | LABETTE | KS | 67350 | 76 |
| STAR-SEED-830-IRRIGATED | HRW | FINNEY-CO | KS | 67846 | 73 |
| STEPHENS | SWW | WASCO-CO | OR | 97063 | 21 |
| STEPHENS | SWW | MADRAS | OR | 97741 | 23 |
| STEPHENS | SWW | MADRAS | OR | 97741 | 24 |
| STEPHENS | SWW | MADRAS | OR | 97741 | 24 |
| STEPHENS | SWW | HERMISTON | OR | 97838 | 24 |
| STEPHENS | SWW | MADRAS | OR | 97741 | 26 |
| STEPHENS | SWW | MADRAS | OR | 97741 | 26 |
| STEPHENS | SWW | MADRAS | OR | 97741 | 27 |
| STEPHENS | SWW | PENDLETON | OR | 97801 | 27 |
| STEPHENS | SWW | MADRAS | OR | 97741 | 27 |
| STEPHENS | SWW | MADRAS | OR | 97741 | 27 |
| STEPHENS | SWW | MADRAS | OR | 97741 | 28 |
| STEPHENS | SWW | MORO | OR | 97039 | 30 |
| STOA | HRS | SELBY | SD | 57472 | 64 |
| STOA | HRS | CROOKSTON | MN | 56716 | 73 |
| STOA | HRS | HIGHMORE | SD | 57345 | 77 |
| STOA | HRS | MORRIS | MN | 56267 | 79 |
| STOA | HRS | BROOKINGS | SD | 57006 | 85 |
| STOA | HRS | ST-PAUL | MN | 55101 | 87 |
| TAM-101 | HRW | CHILICOTHE | TX | 76384 | 52 |
| TAM-101 | HRW | WOODWARD | OK | 73801 | 52 |
| TAM-101 | HRW | OLNEY | TX | 76374 | 53 |
| TAM-101 | HRW | MUNDAY | TX | 76301 | 57 |
| TAM-101 | HRW | TOLBERT | TX | 76384 | 63 |
| TAM-101-87 | HRW | WOODWARD | OK | 73801 | 45 |
| TAM-101-87 | HRW | STILLWELL | OK | 74960 | 45 |
| TAM-101-87 | HRW | LAHOMA | OK | 73754 | 51 |
| TAM-101-87 | HRW | GOODWELL | OK | 73939 | 57 |
| TAM-101-87-IRRIGATED | HRW | GOODWELL | OK | 73939 | 55 |
| TAM-101-88 | HRW | ALTUS | OK | 73521 | 44 |
| TAM-101-88 | HRW | LAHOMA | OK | 73754 | 51 |
| TAM-101-88 | HRW | ALTUS | OK | 73521 | 57 |
| TAM-101-88 | HRW | GOODWELL | OK | 73939 | 58 |

TABLE 4. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|----------------------|-------|-------------|-------|---------|----------|
| TAM-101-88 | HRW | STILLWELL | OK | 74960 | 63 |
| TAM-101-88-IRRIGATED | HRW | GOODWELL | OK | 73939 | 62 |
| TAM-105 | HRW | CHILICOTHE | TX | 76384 | 63 |
| TAM-105 | HRW | FRANKLIN-CO | KS | 66067 | 63 |
| TAM-105 | HRW | MUNDAY | TX | 76301 | 65 |
| TAM-105 | HRW | OLNEY | TX | 76374 | 66 |
| TAM-105 | HRW | NORDIN | OK | 74631 | 68 |
| TAM-105 | HRW | TOLBERT | TX | 76384 | 73 |
| TAM-105-DRYLAND | HRW | RENO-CO | KS | 67501 | 44 |
| TAM-105-DRYLAND | HRW | THOMAS-CO | KS | 66701 | 53 |
| TAM-105-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 56 |
| TAM-105-DRYLAND | HRW | BROWN-CO | KS | 66434 | 56 |
| TAM-105-DRYLAND | HRW | STAFFORD-CO | KS | 67576 | 62 |
| TAM-105-DRYLAND | HRW | HARVEY-CO | KS | 67114 | 63 |
| TAM-105-DRYLAND | HRW | REPUBLIC-CO | KS | 66935 | 64 |
| TAM-105-DRYLAND | HRW | RILEY-CO | KS | 66502 | 65 |
| TAM-105-DRYLAND | HRW | ELLIS-CO | KS | 67601 | 69 |
| TAM-105-DRYLAND | HRW | LABETTE | KS | 67350 | 74 |
| TAM-105-DRYLAND | HRW | FINNEY-CO | KS | 67846 | 76 |
| TAM-105-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 79 |
| TAM-105-IRRIGATED | HRW | STAFFORD-CO | KS | 67576 | 57 |
| TAM-105-IRRIGATED | HRW | FINNEY-CO | KS | 67846 | 66 |
| TAM-105-IRRIGATED | HRW | THOMAS-CO | KS | 66701 | 69 |
| TAM-107 | HRW | OLNEY | TX | 76374 | 59 |
| TAM-107 | HRW | MORAN | KS | 66755 | 63 |
| TAM-107 | HRW | TOLBERT | TX | 76384 | 70 |
| TAM-107 | HRW | NORDIN | OK | 74631 | 70 |
| TAM-107 | HRW | BURDETT | KS | 67523 | 71 |
| TAM-107 | HRW | FRANKLIN-CO | KS | 66067 | 71 |
| TAM-107 | HRW | CHILICOTHE | TX | 76384 | 74 |
| TAM-107 | HRW | MUNDAY | TX | 76301 | 74 |
| TAM-107 | HRW | SUBLETTE | KS | 67877 | 74 |
| TAM-107 | HRW | LARNED | KS | 67550 | 79 |
| TAM-107 | HRW | SATANTA | KS | 67870 | 79 |
| TAM-107 | HRW | WINONA | KS | 67764 | 79 |
| TAM-107 | HRW | TIMKEN | KS | 67582 | 81 |
| TAM-107 | HRW | BELVUE | KS | 66407 | 81 |
| TAM-107 | HRW | GARDEN-CITY | KS | 67846 | 82 |
| TAM-107 | HRW | MANTER | KS | 67862 | 83 |
| TAM-107-DRYLAND | HRW | LABETTE | KS | 67350 | 53 |
| TAM-107-DRYLAND | HRW | RENO-CO | KS | 67501 | 54 |
| TAM-107-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 65 |
| TAM-107-DRYLAND | HRW | STAFFORD-CO | KS | 67576 | 68 |
| TAM-107-DRYLAND | HRW | BROWN-CO | KS | 66434 | 71 |
| TAM-107-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 71 |
| TAM-107-DRYLAND | HRW | THOMAS-CO | KS | 66701 | 72 |
| TAM-107-DRYLAND | HRW | RILEY-CO | KS | 66502 | 72 |
| DRYLAND | HRW | REPUBLIC-CO | KS | 66935 | 73 |
| DRYLAND | HRW | ELLIS-CO | KS | 67601 | 73 |
| DRYLAND | HRW | FINNEY-CO | KS | 67846 | 74 |
| IRRIGATED | HRW | FINNEY-CO | KS | 67846 | 69 |

TABLE 4. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|--------------------|-------|--------------|-------|---------|----------|
| TAM-107-IRRIGATED | HRW | THOMAS-CO | KS | 66701 | 72 |
| TAM-108 | HRW | CHILICOTHE | TX | 76384 | 39 |
| TAM-108 | HRW | TOLBERT | TX | 76384 | 42 |
| TAM-108 | HRW | OLNEY | TX | 76374 | 43 |
| TAM-108 | HRW | MORO | OR | 97039 | 43 |
| TAM-108 | HRW | NORDIN | OK | 74631 | 48 |
| TAM-108 | HRW | FRANKLIN-CO | KS | 66067 | 49 |
| TAM-108 | HRW | THOMAS-CO | KS | 66701 | 64 |
| TAM-108-DRYLAND | HRW | RENO-CO | KS | 67501 | 33 |
| TAM-108-DRYLAND | HRW | RENO-CO | KS | 67501 | 40 |
| TAM-108-DRYLAND | HRW | STAFFORD-CO | KS | 67576 | 44 |
| TAM-108-DRYLAND | HRW | BROWN-CO | KS | 66434 | 45 |
| TAM-108-DRYLAND | HRW | HARVEY-CO | KS | 67114 | 47 |
| TAM-108-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 50 |
| TAM-108-DRYLAND | HRW | RILEY-CO | KS | 66502 | 51 |
| TAM-108-DRYLAND | HRW | REPUBLIC-CO | KS | 66935 | 55 |
| TAM-108-DRYLAND | HRW | FINNEY-CO | KS | 67846 | 59 |
| TAM-108-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 66 |
| TAM-108-DRYLAND | HRW | ELLIS-CO | KS | 67601 | 67 |
| TAM-108-DRYLAND | HRW | LABETTE | KS | 67350 | 79 |
| TAM-108-IRRIGATED | HRW | FINNEY-CO | KS | 67846 | 47 |
| TAM-108-IRRIGATED | HRW | STAFFORD-CO | KS | 67576 | 50 |
| TAM-108-IRRIGATED | HRW | THOMAS-CO | KS | 66701 | 55 |
| TAM-200 | HRW | TOLBERT | TX | 76384 | 64 |
| TAM-200 | HRW | OLNEY | TX | 76374 | 65 |
| TAM-200 | HRW | NORDIN | OK | 74631 | 66 |
| TAM-200 | HRW | MUNDAY | TX | 76301 | 72 |
| TAM-200 | HRW | CHILICOTHE | TX | 76384 | 73 |
| TAM-200-DRYLAND | HRW | RENO-CO | KS | 67501 | 43 |
| TAM-200-DRYLAND | HRW | HARVEY-CO | KS | 67114 | 46 |
| TAM-200-DRYLAND | HRW | STAFFORD-CO | KS | 67576 | 53 |
| TAM-200-DRYLAND | HRW | RILEY-CO | KS | 66502 | 55 |
| TAM-200-DRYLAND | HRW | THOMAS-CO | KS | 66701 | 57 |
| TAM-200-DRYLAND | HRW | REPUBLIC-CO | KS | 66935 | 59 |
| TAM-200-DRYLAND | HRW | ELLIS-CO | KS | 67601 | 60 |
| TAM-200-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 68 |
| TAM-200-IRRIGATED | HRW | FINNEY-CO | KS | 67846 | 59 |
| TAM-200-IRRIGATED | HRW | GREELEY-CO | KS | 67879 | 59 |
| TAM-200-IRRIGATED | HRW | THOMAS-CO | KS | 66701 | 59 |
| TAM-201 | HRW | OLNEY | TX | 76374 | 55 |
| TAM-201 | HRW | CHILICOTHE | TX | 76384 | 67 |
| TAM-201 | HRW | TOLBERT | TX | 76384 | 69 |
| TAM-201 | HRW | MUNDAY | TX | 76301 | 73 |
| TERRA-SR86-DRYLAND | SRW | LABETTE | KS | 67350 | 30 |
| THUNDERBIRD | HRW | DERBY | KS | 67037 | 60 |
| THUNDERBIRD | HRW | GARDEN-CITY | KS | 67846 | 67 |
| THUNDERBIRD | HRW | GREELEY | KS | 66033 | 67 |
| THUNDERBIRD | HRW | PALMER | KS | 66962 | 68 |
| THUNDERBIRD | HRW | HUGOTON | KS | 67951 | 68 |
| THUNDERBIRD | HRW | LITTLE-RIVER | KS | 67457 | 70 |
| THUNDERBIRD | HRW | GIRARD | KS | 66743 | 71 |

TABLE 4. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|-------------------------|-------|--------------|-------|---------|----------|
| THUNDERBIRD | HRW | GARDEN-CITY | KS | 67846 | 80 |
| THUNDERBIRD | HRW | GARDEN-CITY | KS | 67846 | 81 |
| THUNDERBIRD | HRW | ULYSSES | KS | 67880 | 85 |
| THUNDERBIRD-DRYLAND | HRW | RENO-CO | KS | 67501 | 51 |
| THUNDERBIRD-DRYLAND | HRW | BROWN-CO | KS | 66434 | 61 |
| THUNDERBIRD-DRYLAND | HRW | HARVEY-CO | KS | 67114 | 66 |
| THUNDERBIRD-DRYLAND | HRW | FRANKLIN-CO | KS | 66067 | 66 |
| THUNDERBIRD-DRYLAND | HRW | RILEY-CO | KS | 66502 | 68 |
| THUNDERBIRD-DRYLAND | HRW | REPUBLIC-CO | KS | 66935 | 68 |
| THUNDERBIRD-DRYLAND | HRW | THOMAS-CO | KS | 66701 | 70 |
| THUNDERBIRD-DRYLAND | HRW | FINNEY-CO | KS | 67846 | 71 |
| THUNDERBIRD-DRYLAND | HRW | GREELEY-CO | KS | 67879 | 78 |
| THUNDERBIRD-DRYLAND | HRW | ELLIS-CO | KS | 67601 | 80 |
| THUNDERBIRD-DRYLAND | HRW | LABETTE | KS | 67350 | 80 |
| THUNDERBIRD-IRRIGATED | HRW | STAFFORD-CO | KS | 67576 | 67 |
| THUNDERBIRD-IRRIGATED | HRW | FINNEY-CO | KS | 67846 | 69 |
| THUNDERBIRD-IRRIGATED | HRW | THOMAS-CO | KS | 66701 | 70 |
| THUNDERBIRD-IRRIGATED | HRW | GREELEY-CO | KS | 67879 | 72 |
| TRAILBLAZER | HRW | NORDIN | OK | 74631 | 68 |
| TRAILBLAZER-DRYLAND | HRW | BROWN-CO | KS | 66434 | 65 |
| TRAILBLAZER-DRYLAND | HRW | REPUBLIC-CO | KS | 66935 | 65 |
| TRES | CLUB | WASCO-CO | OR | 97063 | 25 |
| TRES | CLUB | MORO | OR | 97039 | 27 |
| TRES | CLUB | HERMISTON | OR | 97838 | 30 |
| TRES | CLUB | PENDLETON | OR | 97801 | 31 |
| TRIUMPH-64 | HRW | INMAN | KS | 67546 | 55 |
| TRIUMPH-64-87 | HRW | STILLWELL | OK | 74960 | 40 |
| TRIUMPH-64-87 | HRW | WOODWARD | OK | 73801 | 41 |
| TRIUMPH-64-87-IRRIGATED | HRW | GOODWELL | OK | 73939 | 57 |
| TRIUMPH-64-88 | HRW | ALTUS | OK | 73521 | 40 |
| TRIUMPH-64-88 | HRW | ALTUS | OK | 73521 | 52 |
| TRIUMPH-64-88 | HRW | WOODWARD | OK | 73801 | 53 |
| TRIUMPH-64-88 | HRW | GOODWELL | OK | 73939 | 53 |
| TRIUMPH-64-88 | HRW | STILLWELL | OK | 74960 | 54 |
| TRIUMPH-64-88 | HRW | LAHOMA | OK | 73754 | 57 |
| TRIUMPH-64-88-IRRIGATED | HRW | GOODWELL | OK | 73939 | 59 |
| TRIUMPH-64-DRYLAND | HRW | RENO-CO | KS | 67501 | 47 |
| TRIUMPH-64-DRYLAND | HRW | LABETTE | KS | 67350 | 68 |
| VICTORY | HRW | WINFIELD | KS | 67156 | 54 |
| VICTORY | HRW | BELLE-PLAINE | KS | 67013 | 57 |
| VICTORY | HRW | WILSEY | KS | 66873 | 59 |
| VICTORY | HRW | PALMER | KS | 66962 | 69 |
| VICTORY | HRW | OSBORN | KS | 67473 | 72 |
| VICTORY | HRW | GARDEN-CITY | KS | 67846 | 78 |
| VICTORY-DRYLAND | HRW | BROWN-CO | KS | 66434 | 57 |
| VICTORY-DRYLAND | HRW | HARVEY-CO | KS | 67114 | 58 |
| VICTORY-DRYLAND | HRW | RILEY-CO | KS | 66502 | 60 |
| VICTORY-DRYLAND | HRW | FRANKLIN-CO | KS | 66067 | 63 |
| VICTORY-DRYLAND | HRW | STAFFORD-CO | KS | 67576 | 63 |
| VICTORY-DRYLAND | HRW | REPUBLIC-CO | KS | 66935 | 63 |
| VICTORY-DRYLAND | HRW | THOMAS-CO | KS | 66701 | 67 |

TABLE 4. NIR HARDNESS OF BREEDERS' SAMPLES, LISTED BY VARIETY.

| VARIETY | CLASS | REGION | STATE | ZIPCODE | HARDNESS |
|---------------------|-------|-------------|-------|---------|----------|
| VICTORY-DRYLAND | HRW | ELLIS-CO | KS | 67601 | 67 |
| VICTORY-DRYLAND | HRW | FINNEY-CO | KS | 67846 | 68 |
| VICTORY-DRYLAND | HRW | LABETTE | KS | 67350 | 68 |
| VICTORY-IRRIGATED | HRW | FINNEY-CO | KS | 67846 | 61 |
| VICTORY-IRRIGATED | HRW | STAFFORD-CO | KS | 67576 | 61 |
| VICTORY-IRRIGATED | HRW | GREELEY-CO | KS | 67879 | 63 |
| VICTORY-IRRIGATED | HRW | THOMAS-CO | KS | 66701 | 66 |
| VONA-DRYLAND | HRW | STAFFORD-CO | KS | 67576 | 51 |
| W85-120-EXP-DRYLAND | HRW | BROWN-CO | KS | 66434 | 64 |
| W85-120-EXP-DRYLAND | HRW | FRANKLIN-CO | KS | 66067 | 67 |
| W85-120-EXP-DRYLAND | HRW | LABETTE | KS | 67350 | 80 |
| W85-162-EXP-DRYLAND | HRW | RILEY-CO | KS | 66502 | 59 |
| WHEATON | HRS | CROOKSTON | MN | 56716 | 70 |
| WHEATON | HRS | MORRIS | MN | 56267 | 75 |
| WRANGLER | HRW | NORDIN | OK | 74631 | 67 |

TABLE 5. AVERAGE NIR HARDNESS OF ALL SAMPLES FOR EACH VARIETY.

| VARIETY | CLASS | STATE | NO. SAMPLES | HARDNESS | |
|--------------------|-------|-------|----------------|----------|-----------|
| | | | | MEAN | STD. DEV. |
| 40A-DYNASTY | SRW | OH | 1 | 22 | - |
| 906-R | HRS | ND | 1 | 74 | - |
| ABILENE | HRW | KS | 11 | 70 | 5 |
| ABILENE | HRW | OK | 1 | 64 | - |
| ABILENE-DRYLAND | HRW | KS | 12 | 62 | 7 |
| ABILENE-IRRIGATED | HRW | KS | 2 | 60 | 0 |
| AGRI-PRO | HRW | KS | 2 | 66 | 21 |
| ALEX | HRS | ND | 4 | 87 | 4 |
| ANZA | HRW | CA | 17 | 75 | 5 |
| APEX | HRS | ND | 1 | 69 | - |
| ARKAN | HRW | KS | 89 | 61 | 6 |
| ARKAN | HRW | OK | 2 | 58 | 1 |
| ARKAN-DRYLAND | HRW | KS | 12 | 57 | 6 |
| ARKAN-IRRIGATED | HRW | KS | 4 | 60 | 4 |
| AUBURN | SRW | MO | 1 | 33 | - |
| BACA | HRW | CO | 4 | 60 | 3 |
| BECKER | SRW | OH | 5 | 21 | 3 |
| BECKER-DRYLAND | SRW | KS | 2 | 21 | 6 |
| BH-122 | HRW | OK | 1 | 51 | - |
| BH-122-DRYLAND | HRW | KS | 8 | 53 | 8 |
| BH-122-IRRIGATED | HRW | KS | 3 | 53 | 5 |
| BH-203A-DRYLAND | HRW | KS | 7 | 44 | 6 |
| BH-203A-IRRIGATED | HRW | KS | 3 | 45 | 3 |
| BH-206-DRYLAND | HRW | KS | 1 | 47 | - |
| BH-206-IRRIGATED | HRW | KS | 1 | 62 | - |
| BH-301 | HRW | OK | 1 | 63 | - |
| BOUNTY | HRW | KS | 1 | 84 | - |
| BOUNTY-205 | HRW | KS | 2 | 37 | 2 |
| BRONCO-DRYLAND | HRW | KS | 3 | 60 | 4 |
| BRONZE-CHIEF | HRS | MT | 1 | 72 | - |
| BRULE | HRW | CO | 5 | 59 | 11 |
| BRULE | HRW | KS | 1 | 69 | - |
| BRULE | HRW | NE | 11 | 60 | 5 |
| BUCKSKIN | HRW | NE | 4 | 70 | 2 |
| BUTTE | HRS | ND | 1 | 96 | - |
| BUTTE | HRS | SD | 1 | 72 | - |
| BUTTE-86 | HRS | MN | 6 | 87 | 2 |
| BUTTE-86 | HRS | MT | 1 | 88 | - |
| BUTTE-86 | HRS | ND | 26 | 89 | 7 |
| BUTTE-86 | HRS | SD | 3 | 82 | 4 |
| CALDWELL | SRW | KS | 3 | 22 | 3 |
| CALDWELL | SRW | MO | 10 | 28 | 6 |
| CALDWELL | SRW | OH | 8 | 27 | 3 |
| CALDWELL | SRW | OK | 1 | 32 | - |
| CALDWELL-DRYLAND | SRW | KS | 3 | 22 | 3 |
| CALDWELL-IRRIGATED | SRW | KS | 1 | 25 | - |
| CARDINAL | SRW | OH | 4 | 23 | 1 |
| CARSON | HRW | CO | 2 | 67 | 2 |
| CARSON | HRW | OK | 1 | 68 | - |

TABLE 5. AVERAGE NIR HARDNESS OF ALL SAMPLES FOR EACH VARIETY.

| VARIETY | CLASS | STATE | NO. SAMPLES | HARDNESS | |
|------------------------|-------|-------|----------------|----------|-----------|
| | | | | MEAN | STD. DEV. |
| CARSON-DRYLAND | HRW | KS | 3 | 65 | 4 |
| CELTIC | HRS | MN | 1 | 81 | - |
| CELTIC | HRS | ND | 1 | 80 | - |
| CENTURA | HRW | NE | 18 | 64 | 8 |
| CENTURA-DRYLAND | HRW | KS | 7 | 67 | 9 |
| CENTURK | HRW | NE | 3 | 63 | 12 |
| CENTURK-78 | HRW | KS | 1 | 64 | - |
| CENTURK-78 | HRW | NE | 3 | 69 | 5 |
| CENTURY | HRW | OR | 2 | 55 | 4 |
| CENTURY | HRW | TX | 3 | 58 | 5 |
| CENTURY-87 | HRW | OK | 3 | 49 | 7 |
| CENTURY-87-IRRIGATED | HRW | OK | 1 | 59 | - |
| CENTURY-88 | HRW | OK | 6 | 55 | 10 |
| CENTURY-88-IRRIGATED | HRW | OK | 1 | 54 | - |
| CENTURY-DRYLAND | HRW | KS | 9 | 61 | 8 |
| CENTURY-IRRIGATED | HRW | KS | 3 | 59 | 4 |
| CENEY | HRW | KS | 1 | 72 | - |
| CHEYENNE | HRW | NE | 1 | 61 | - |
| CHEYENNE | HRW | OR | 2 | 63 | 2 |
| CHISHOLM | HRW | KS | 1 | 40 | - |
| CHISHOLM | HRW | OK | 92 | 45 | 7 |
| CHISHOLM | HRW | TX | 3 | 32 | 1 |
| CHISHOLM-87 | HRW | OK | 4 | 30 | 7 |
| CHISHOLM-88 | HRW | OK | 6 | 37 | 8 |
| CHISHOLM-88-IRRIGATED | HRW | OK | 1 | 38 | - |
| CHISHOLM-DRYLAND | HRW | KS | 10 | 40 | 5 |
| CHISHOLM-IRRIGATED | HRW | KS | 2 | 45 | 12 |
| CO820026-EXP-DRYLAND | HRW | KS | 1 | 60 | - |
| CO820026-EXP-IRRIGATED | HRW | KS | 2 | 58 | 6 |
| CODY | HRW | NE | 5 | 57 | 10 |
| CODY-DRYLAND | HRW | KS | 4 | 73 | 3 |
| CODY-IRRIGATED | HRW | KS | 2 | 66 | 1 |
| COLLIN | HRW | TX | 4 | 25 | 3 |
| COLT | HRW | KS | 1 | 62 | - |
| COLT | HRW | NE | 8 | 52 | 7 |
| COLT | HRW | OR | 2 | 47 | 6 |
| COLT-DRYLAND | HRW | KS | 5 | 56 | 6 |
| COLT-IRRIGATED | HRW | KS | 1 | 62 | - |
| COLUMBUS | HRS | ND | 5 | 86 | 11 |
| COMPTON-DRYLAND | SRW | KS | 4 | 21 | 4 |
| COMPTON-IRRIGATED | SRW | KS | 1 | 18 | - |
| CONCHO | HRW | KS | 1 | 66 | - |
| CONCHO | HRW | OK | 5 | 39 | 2 |
| COTEAU | HRS | ND | 10 | 89 | 5 |
| CREE | HRW | MT | 1 | 63 | - |
| CUTLESS | HRS | MT | 1 | 81 | - |
| DAWN | HRW | SD | 4 | 55 | 5 |
| DELANGE-7834-DRYLAND | HRW | KS | 1 | 62 | - |
| DELANGE-7837-DRYLAND | HRW | KS | 8 | 56 | 8 |

TABLE 5. AVERAGE NIR HARDNESS OF ALL SAMPLES FOR EACH VARIETY.

| VARIETY | CLASS | STATE | NO. SAMPLES | HARDNESS | |
|----------------------|-------|-------|----------------|----------|-----------|
| | | | | MEAN | STD. DEV. |
| DELANGE-7846-DRYLAND | HRW | KS | 8 | 55 | 9 |
| DODGE | HRW | KS | 6 | 68 | 4 |
| DODGE | HRW | OR | 2 | 53 | 6 |
| DODGE-DRYLAND | HRW | KS | 9 | 65 | 8 |
| DODGE-IRRIGATED | HRW | KS | 2 | 61 | 7 |
| DUSTY | SWW | OR | 4 | 17 | 4 |
| DYNASTY | SRW | OH | 1 | 23 | - |
| EAGLE | HRW | KS | 9 | 73 | 5 |
| FORTUNA | HRS | MT | 1 | 81 | - |
| FS402 | SRW | OH | 2 | 25 | 0 |
| GARST | HRW | KS | 1 | 65 | - |
| GARST-HR48 | HRW | KS | 1 | 73 | - |
| GARST-HR64 | HRW | KS | 2 | 69 | 10 |
| GENIE-II | SRW | MO | 1 | 29 | - |
| GLENMAN | HRS | MT | 3 | 75 | 11 |
| GR860 | SRW | OH | 2 | 25 | 0 |
| GR876 | SRW | OH | 2 | 28 | 3 |
| GUARD | HRS | MN | 2 | 75 | 1 |
| GUARD | HRS | SD | 4 | 68 | 5 |
| GUERT-2 | HRW | MT | 1 | 64 | - |
| HAIL | HRW | CO | 1 | 58 | - |
| HART | SRW | OH | 1 | 30 | - |
| HAWK | HRW | CO | 6 | 64 | 8 |
| HAWK | HRW | KS | 26 | 69 | 6 |
| HAWK | HRW | NE | 6 | 61 | 8 |
| HAWK | HRW | TX | 3 | 68 | 7 |
| HILL-81 | SWW | OR | 5 | 24 | 3 |
| KARL | HRW | OK | 1 | 58 | - |
| KARL | HRW | TX | 4 | 59 | 8 |
| KARL-DRYLAND | HRW | KS | 9 | 62 | 9 |
| KARL-IRRIGATED | HRW | KS | 4 | 62 | 5 |
| KASSTO | HWW | CA | 7 | 65 | 3 |
| | HRW | OR | 1 | 68 | - |
| | HWW | OR | 2 | 68 | 4 |
| | | | 4 | 56 | 9 |
| | | | 1 | 68 | - |
| | | | 1 | 70 | - |
| | | | 1 | 67 | - |
| | | | 2 | 74 | 4 |
| | | | 1 | 69 | - |
| | | | 28 | 70 | 4 |
| | | | 10 | 63 | 8 |
| | | | 3 | 78 | 5 |
| | | | 18 | 85 | 4 |
| | | | 3 | 80 | 8 |
| | | | 2 | 25 | 2 |
| | | | 3 | 26 | 5 |
| | | | 48 | 79 | 8 |
| | | | 14 | 82 | 7 |

TABLE 5. AVERAGE NIR HARDNESS OF ALL SAMPLES FOR EACH VARIETY.

| VARIETY | CLASS | STATE | NO. SAMPLES | HARDNESS | |
|----------------------|-------|-------|----------------|----------|-----------|
| | | | | MEAN | STD. DEV. |
| MARSHALL | HRS | SD | 4 | 72 | 5 |
| MESA | HRW | CO | 1 | 65 | - |
| MESA | HRW | KS | 16 | 69 | 6 |
| MESA | HRW | TX | 4 | 64 | 6 |
| MESA-DRYLAND | HRW | KS | 11 | 64 | 7 |
| MESA-IRRIGATED | HRW | KS | 3 | 62 | 2 |
| MO-9965-EXP-DRYLAND | SRW | KS | 4 | 13 | 3 |
| MUSTANG | HRW | CO | 2 | 52 | 0 |
| MUSTANG | HRW | KS | 24 | 67 | 7 |
| MUSTANG | HRW | OK | 7 | 62 | 5 |
| MUSTANG | HRW | TX | 3 | 58 | 6 |
| MUSTANG-87 | HRW | OK | 3 | 52 | 10 |
| MUSTANG-87-IRRIGATED | HRW | OK | 1 | 51 | - |
| MUSTANG-88 | HRW | OK | 1 | 39 | - |
| MUSTANG-DRYLAND | HRW | KS | 10 | 60 | 8 |
| MUSTANG-IRRIGATED | HRW | KS | 2 | 61 | 1 |
| McNAIR-1003 | SRW | KS | 1 | 25 | - |
| NEWANA | HRS | MT | 4 | 75 | 4 |
| NEWTON | HRW | CO | 2 | 60 | 5 |
| NEWTON | HRW | KS | 59 | 62 | 6 |
| NEWTON-DRYLAND | HRW | KS | 12 | 57 | 7 |
| NEWTON-IRRIGATED | HRW | KS | 3 | 52 | 2 |
| NK-711 | HRS | MN | 1 | 79 | - |
| NK-812 | HRW | OK | 2 | 82 | 4 |
| NK-830 | HRW | KS | 2 | 77 | 1 |
| NK-PRO-812 | HRW | TX | 3 | 70 | 7 |
| NORKAN | HRW | KS | 12 | 64 | 6 |
| NORKAN | HRW | NE | 1 | 59 | - |
| NORKAN | HRW | OK | 1 | 65 | - |
| NORKAN | HRW | OR | 2 | 64 | 5 |
| NORKAN-DRYLAND | HRW | KS | 10 | 61 | 8 |
| NORKAN-IRRIGATED | HRW | KS | 3 | 62 | 3 |
| NORSEMAN | HRS | ND | 4 | 93 | 17 |
| NORSTAR | HRW | MT | 1 | 64 | - |
| OR-CR8313 | HRW | OR | 4 | 63 | 3 |
| OR8400464P | SWW | OR | 2 | 24 | 6 |
| OR8400882H | SWW | OR | 3 | 26 | 2 |
| OR8500305P | SWW | OR | 2 | 24 | 6 |
| OR8500374H | HWW | OR | 2 | 62 | 4 |
| OR8500378H | HWW | OR | 3 | 60 | 5 |
| OR8500974P | SWW | OR | 3 | 29 | 4 |
| OR8502288H | SWW | OR | 3 | 23 | 4 |
| OR8505311P | SWW | OR | 3 | 37 | 13 |
| OR8600049 | HWW | OR | 3 | 67 | 4 |
| OR8600341 | HWW | OR | 3 | 66 | 2 |
| OR8600471 | HWW | OR | 2 | 51 | 5 |
| OR8600701 | HWW | OR | 3 | 69 | 4 |
| OR860292 | SWW | OR | 2 | 23 | 3 |
| OR860293 | SWW | OR | 3 | 23 | 2 |

TABLE 5. AVERAGE NIR HARDNESS OF ALL SAMPLES FOR EACH VARIETY.

| VARIETY | CLASS | STATE | NO. SAMPLES | HARDNESS | |
|---------------------------|-------|-------|----------------|----------|-----------|
| | | | | MEAN | STD. DEV. |
| OR860296 | SWW | OR | 3 | 31 | 1 |
| OR860297 | HWW | OR | 2 | 28 | 4 |
| OR860301 | SWW | OR | 3 | 22 | 1 |
| OR860302 | SWW | OR | 3 | 24 | 3 |
| OR860303 | SWW | OR | 3 | 23 | 4 |
| OR860436 | SWW | OR | 2 | 22 | 2 |
| OR860553 | SWW | OR | 3 | 28 | 3 |
| OR860571 | SWW | OR | 3 | 22 | 5 |
| OR860575 | SWW | OR | 2 | 21 | 5 |
| OR860576 | SWW | OR | 3 | 31 | 1 |
| OR860754 | SWW | OR | 3 | 30 | 5 |
| OR860756 | HWW | OR | 3 | 47 | 8 |
| OR861219 | SWW | OR | 2 | 28 | 2 |
| OR861226 | SWW | OR | 3 | 28 | 1 |
| OR861425 | SWW | OR | 3 | 28 | 2 |
| OVESON | SWW | OR | 5 | 25 | 6 |
| PARKER | HRW | KS | 2 | 69 | 6 |
| PIKE | SRW | MO | 7 | 14 | 5 |
| PIONEER | HRW | KS | 2 | 53 | 0 |
| PIONEER | HRW | MN | 1 | 88 | - |
| PIONEER | HRW | ND | 1 | 89 | - |
| PIONEER | HRW | OK | 6 | 61 | 8 |
| PIONEER | SRW | OH | 3 | 25 | 6 |
| PIONEER-17707 | HRS | ND | 1 | 97 | - |
| PIONEER-2154 | HRW | KS | 1 | 71 | - |
| PIONEER-2154 | HRW | OK | 1 | 78 | - |
| PIONEER-2154-DRYLAND | HRW | KS | 10 | 75 | 7 |
| PIONEER-2154-IRRIGATED | HRW | KS | 2 | 76 | 1 |
| PIONEER-2157 | HRW | KS | 13 | 59 | 5 |
| PIONEER-2157 | HRW | OK | 41 | 60 | 6 |
| PIONEER-2157-88 | HRW | OK | 5 | 55 | 5 |
| PIONEER-2157-88-IRRIGATED | HRW | OK | 1 | 54 | - |
| PIONEER-2157-DRYLAND | HRW | KS | 9 | 55 | 8 |
| PIONEER-2157-IRRIGATED | HRW | KS | 3 | 55 | 3 |
| PIONEER-2163 | HRW | OK | 1 | 62 | - |
| PIONEER-2165 | HRW | KS | 2 | 67 | 1 |
| PIONEER-2172 | HRW | KS | 2 | 66 | 13 |
| PIONEER-2172 | HRW | OK | 1 | 74 | - |
| PIONEER-2172-DRYLAND | HRW | KS | 11 | 71 | 9 |
| PIONEER-2172-IRRIGATED | HRW | KS | 3 | 74 | 3 |
| PIONEER-2306 | HRS | MN | 1 | 78 | - |
| PIONEER-2360 | HRS | MN | 2 | 81 | 4 |
| PIONEER-2364 | HRS | SD | 1 | 79 | - |
| PIONEER-2369 | HRS | MN | 1 | 95 | - |
| PIONEER-2369 | HRS | ND | 2 | 90 | 0 |
| PIONEER-2369 | HRS | SD | 2 | 74 | 4 |
| PIONEER-2385 | HRS | MN | 3 | 80 | 4 |
| PIONEER-2385 | HRS | ND | 3 | 83 | 3 |
| PIONEER-2550 | SRW | OH | 1 | 22 | - |

TABLE 5. AVERAGE NIR HARDNESS OF ALL SAMPLES FOR EACH VARIETY.

| VARIETY | CLASS | STATE | NO. SAMPLES | HARDNESS | |
|------------------------|-------|-------|----------------|----------|-----------|
| | | | | MEAN | STD. DEV. |
| PIONEER-2551 | SRW | KS | 1 | 23 | - |
| PIONEER-2551 | SRW | OR | 2 | 23 | 2 |
| PIONEER-2551-DRYLAND | SRW | KS | 3 | 19 | 3 |
| PIONEER-5757 | HRW | KS | 2 | 56 | 2 |
| PLAINSMAN | HRW | KS | 1 | 67 | - |
| PRO-BRAND-830 | HRW | KS | 11 | 69 | 5 |
| QUANTUM | HRW | KS | 1 | 60 | - |
| QUANTUM-378 | HRW | OK | 1 | 57 | - |
| QUANTUM-562-DRYLAND | HRW | KS | 3 | 61 | 2 |
| QUANTUM-564 | HRW | OK | 1 | 54 | - |
| QUANTUM-578-DRYLAND | HRW | KS | 2 | 70 | 9 |
| QUANTUM-578-IRRIGATED | HRW | KS | 3 | 59 | 4 |
| REDLAND | HRW | NE | 4 | 60 | 9 |
| REDLAND | HRW | SD | 4 | 53 | 4 |
| REDLAND-DRYLAND | HRW | KS | 5 | 62 | 3 |
| REDWIN | HRW | MT | 1 | 82 | - |
| RH-7833 | HRW | OK | 1 | 57 | - |
| RH-7837 | HRW | OK | 1 | 55 | - |
| RH7837 | HRW | KS | 1 | 61 | - |
| RH7846 | HRW | KS | 2 | 59 | 3 |
| RIO-BLANCO | HWW | OK | 1 | 58 | - |
| RIO-BLANCO-DRYLAND | HWW | KS | 10 | 58 | 7 |
| RIO-BLANCO-IRRIGATED | HWW | KS | 4 | 58 | 1 |
| ROCKY | HRW | KS | 1 | 77 | - |
| ROCKY | HRW | NE | 1 | 76 | - |
| ROSE | HRW | SD | 4 | 61 | 4 |
| ROUGH RIDER | HRW | SD | 4 | 63 | 4 |
| SAGE | HRW | KS | 1 | 68 | - |
| SAGE | HRW | NE | 1 | 43 | - |
| SANDY | HRW | CO | 17 | 63 | 6 |
| SANDY | HRW | KS | 1 | 73 | - |
| SANDY-DRYLAND | HRW | KS | 2 | 71 | 4 |
| SCOTTY | SRW | OH | 1 | 28 | - |
| SCOUT | HRW | CO | 1 | 63 | - |
| SCOUT | HRW | KS | 1 | 68 | - |
| SCOUT | HRW | NE | 1 | 57 | - |
| SCOUT-66 | HRW | CO | 2 | 63 | 2 |
| SCOUT-66 | HRW | KS | 5 | 72 | 6 |
| SCOUT-66 | HRW | NE | 5 | 56 | 6 |
| SCOUT-66 | HRW | SD | 3 | 64 | 2 |
| SCOUT-66 | HRW | TX | 4 | 65 | 2 |
| SCOUT-66-DRYLAND | HRW | KS | 9 | 67 | 4 |
| SIOUXLAND | HRW | KS | 10 | 62 | 5 |
| SIOUXLAND | HRW | NE | 10 | 59 | 9 |
| SIOUXLAND | HRW | OK | 5 | 62 | 3 |
| SIOUXLAND | HRW | SD | 3 | 57 | 3 |
| SIOUXLAND | HRW | TX | 4 | 62 | 4 |
| SIOUXLAND-87 | HRW | OK | 4 | 53 | 6 |
| SIOUXLAND-87-IRRIGATED | HRW | OK | 1 | 59 | - |

TABLE 5. AVERAGE NIR HARDNESS OF ALL SAMPLES FOR EACH VARIETY.

| VARIETY | CLASS | STATE | NO. SAMPLES | HARDNESS | |
|-------------------------|-------|-------|----------------|----------|-----------|
| | | | | MEAN | STD. DEV. |
| IOUXLAND-88 | HRW | OK | 4 | 66 | 5 |
| IOUXLAND-88-IRRIGATED | HRW | OK | 1 | 60 | - |
| IOUXLAND-DRYLAND | HRW | KS | 9 | 63 | 11 |
| IOUXLAND-IRRIGATED | HRW | KS | 4 | 62 | 2 |
| SOLAR-DNS | HRS | MT | 1 | 82 | - |
| STALLION | HRW | CO | 1 | 57 | - |
| STALLION | HRW | KS | 3 | 66 | 3 |
| STALLION | HRW | OK | 2 | 64 | 1 |
| STALLION-DRYLAND | HRW | KS | 4 | 50 | 9 |
| STALLION-IRRIGATED | HRW | KS | 3 | 61 | 2 |
| STAR-SEED-830-DRYLAND | HRW | KS | 4 | 68 | 5 |
| STAR-SEED-830-IRRIGATED | HRW | KS | 1 | 73 | - |
| STEPHENS | SWW | OR | 13 | 26 | 2 |
| STOA | HRS | MN | 12 | 79 | 7 |
| STOA | HRS | ND | 24 | 84 | 6 |
| STOA | HRS | SD | 3 | 75 | 10 |
| SUPER-HAWK | HRW | CO | 1 | 50 | - |
| TAM-101 | HRW | KS | 2 | 57 | 2 |
| TAM-101 | HRW | OK | 4 | 58 | 5 |
| TAM-101 | HRW | TX | 4 | 56 | 5 |
| TAM-101-87 | HRW | OK | 4 | 50 | 6 |
| TAM-101-87-IRRIGATED | HRW | OK | 1 | 55 | - |
| TAM-101-88 | HRW | OK | 5 | 55 | 8 |
| TAM-101-88-IRRIGATED | HRW | OK | 1 | 62 | - |
| TAM-105 | HRW | CO | 1 | 83 | - |
| TAM-105 | HRW | KS | 14 | 69 | 12 |
| TAM-105 | HRW | OK | 1 | 68 | - |
| TAM-105 | HRW | TX | 4 | 66 | 5 |
| TAM-105-DRYLAND | HRW | KS | 12 | 63 | 10 |
| TAM-105-IRRIGATED | HRW | KS | 3 | 64 | 6 |
| TAM-106 | HRW | KS | 1 | 78 | - |
| TAM-107 | HRW | CO | 5 | 78 | 7 |
| TAM-107 | HRW | KS | 21 | 76 | 9 |
| TAM-107 | HRW | NE | 4 | 77 | 3 |
| TAM-107 | HRW | OK | 1 | 70 | - |
| TAM-107 | HRW | TX | 4 | 69 | 7 |
| TAM-107-DRYLAND | HRW | KS | 11 | 68 | 7 |
| TAM-107-IRRIGATED | HRW | KS | 2 | 70 | 2 |
| TAM-108 | HRW | CO | 2 | 35 | 3 |
| TAM-108 | HRW | KS | 6 | 55 | 6 |
| TAM-108 | HRW | OK | 1 | 48 | - |
| TAM-108 | HRW | OR | 1 | 43 | - |
| | | TX | 3 | 41 | 2 |
| | | KS | 12 | 53 | 13 |
| | | KS | 3 | 51 | 4 |
| | | OK | 1 | 66 | - |
| | | TX | 4 | 69 | 5 |
| | | KS | 8 | 55 | 8 |
| | | KS | 3 | 59 | 0 |

TABLE 5. AVERAGE NIR HARDNESS OF ALL SAMPLES FOR EACH VARIETY.

| VARIETY | CLASS | STATE | NO. SAMPLES | HARDNESS | |
|-------------------------|-------|-------|----------------|----------|-----------|
| | | | | MEAN | STD. DEV. |
| TAM-201 | HRW | TX | 4 | 66 | 8 |
| TELEMARK | HRS | MN | 1 | 83 | - |
| TELEMARK | HRS | ND | 1 | 90 | - |
| TERRA-SR86-DRYLAND | SRW | KS | 1 | 30 | - |
| THUNDERBIRD | HRW | CO | 2 | 66 | 1 |
| THUNDERBIRD | HRW | KS | 24 | 74 | 7 |
| THUNDERBIRD | HRW | NE | 2 | 65 | 1 |
| THUNDERBIRD-DRYLAND | HRW | KS | 11 | 69 | 9 |
| THUNDERBIRD-IRRIGATED | HRW | KS | 4 | 69 | 2 |
| TITAN | SRW | OH | 1 | 30 | - |
| TRAILBLAZER | HRW | KS | 2 | 63 | 6 |
| TRAILBLAZER | HRW | OK | 1 | 68 | - |
| TRAILBLAZER-DRYLAND | HRW | KS | 2 | 65 | 0 |
| TRES | CLUB | OR | 4 | 28 | 3 |
| TRIUMPH | HRW | KS | 8 | 62 | 7 |
| TRIUMPH | HRW | OK | 9 | 52 | 3 |
| TRIUMPH-64 | HRW | KS | 1 | 55 | - |
| TRIUMPH-64-87 | HRW | OK | 2 | 40 | 1 |
| TRIUMPH-64-87-IRRIGATED | HRW | OK | 1 | 57 | - |
| TRIUMPH-64-88 | HRW | OK | 6 | 51 | 6 |
| TRIUMPH-64-88-IRRIGATED | HRW | OK | 1 | 59 | - |
| TRIUMPH-64-DRYLAND | HRW | KS | 2 | 58 | 15 |
| TUT | HRW | KS | 1 | 67 | - |
| VICTORY | HRW | CO | 4 | 64 | 3 |
| VICTORY | HRW | KS | 48 | 66 | 7 |
| VICTORY-DRYLAND | HRW | KS | 10 | 63 | 4 |
| VICTORY-IRRIGATED | HRW | KS | 4 | 63 | 2 |
| VONA | HRW | CO | 7 | 64 | 6 |
| VONA | HRW | KS | 3 | 65 | 7 |
| VONA | HRW | NE | 5 | 62 | 6 |
| VONA | HRW | OK | 5 | 54 | 5 |
| VONA-DRYLAND | HRW | KS | 1 | 51 | - |
| W85-120-EXP-DRYLAND | HRW | KS | 3 | 70 | 9 |
| W85-162-EXP-DRYLAND | HRW | KS | 1 | 59 | - |
| WALDRON | HRS | ND | 1 | 95 | - |
| WEATHERMASTER-140A | HRW | KS | 1 | 68 | - |
| WHEATON | HRS | MN | 8 | 78 | 8 |
| WHEATON | HRS | ND | 1 | 76 | - |
| WINGS | HRW | CO | 2 | 48 | 3 |
| WINGS | HRW | KS | 1 | 59 | - |
| WRANGLER | HRW | KS | 2 | 65 | 1 |
| WRANGLER | HRW | OK | 3 | 66 | 2 |
| YECORA-ROJO | HRW | CA | 20 | 73 | 2 |